

POLYCLAD TURBELLARIANS FROM THE SOUTHERN COASTS OF AUSTRALIA

by

STEPHEN PRUDHOE

British Museum (Natural History), London, England

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ABSTRACT

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Eighteen species of polyclad turbellarians are recorded from the southern coasts of Australia, 14 of which are from South Australia and 4 from Victoria. Of the South Australian species, 2 are also recorded from Tasmania, and 1 of the Victorian species has been recorded hitherto only from South Australia. Of the species dealt with, 3 are regarded as new to polyclad systematics, and these are: *Notoplana distincta* sp.nov., and *Pseudoceros lividus* sp.nov., from South Australia and *Candimboides cuneiformis* gen. et sp.nov. from Victoria. The genus *Ancoratheca* is diagnosed. The descriptions are extended for the following 5 species: *Ancoratheca australiensis*, *Notoplana longicrurumena*, *Planocera edmondsi*, *Cestoplana meridionalis* and *Cycloporus australis*. Three known species, *Euplana gracilis*, *Echinoplana tenerrima* and *Pseudoceros reticulatus* show very wide gaps in their geographical distribution, suggesting that polyclads may be artificially transported from one part of the world to another, where they may settle, if conditions are suitable.

INTRODUCTION

Background, Methods and Acknowledgements

The following report is based chiefly on a collection of polyclad turbellarians housed in the South Australian Museum, and for the pleasure of studying this material the writer is indebted to Mr David C. Lee and Mr Ifor M. Thomas. Grateful acknowledgement is made to Dr S. J. Edmonds, formerly the University of Adelaide, Mr S. A. Shepherd of the Department of Fisheries, Adelaide, Dr G. C. B. Poore of the Ministry of Conservation, Melbourne, and Mr Neville Coleman of the Marine Photographic Index, Caringbah, N.S.W., for sending specimens to the writer at different times during the past 25 years.

Little has been published on polyclads of the coasts of South Australia and Victoria and it is therefore not surprising that of the 18 dealt with here only *Notoplana australis* (Schmarda) and *Hoploplana rosea* Prudhoe have been recorded previously from these coasts. Fourteen species are here recorded from South Australia for the first time, and of these 7 are new. Of the known species, 5 have been recorded from the vicinity of Port Jackson, N.S.W., 2 from the coast of Victoria, and 1, *Thysanozoon skottsbergi* Bock, from

the coast of Western Australia. Of the 4 species now recorded from Victoria, only 1 has been recorded from other Australian coasts, but whether or not this relationship denotes any zoogeographical significance requires further investigation of the polyclad fauna of Victoria, especially as Bennett and Pope (1960) indicate the Victorian coast as a cold-temperature zone situated between 2 warm-temperate regions. Hitherto, only 2 species of polyclads have been recorded from Tasmania, namely, *Notoplana australis* and *Microcelis schauinslandi* Plehn, but the number is now increased to 4 with the records of *Planocera edmondsi* Prudhoe, and *Pseudoceros reticulatus* Yeri and Kaburaki.

The present study and a review of the literature, suggest that *Notoplana australis* is probably the commonest species of polyclad inhabiting the southern and south-eastern coasts of Australia. Moreover, the species has also been recorded from New Zealand and Chile.

The occurrence of *Euplana gracilis*, *Echinoplana tenerrima* and *Pseudoceros reticulatus*, inhabitants of other regions of the oceans, in the present collections reveals an important problem in the study of the geographical distribution of polyclad turbellarians, for it now seems that some species are or have been transported artificially by some means or other from their endemic areas to very distant localities offering suitable habitats. This observation gives some credence to Laidlaw's (1904) record of the north-eastern Atlantic boreal polyclad *Cryptocelides loveni* Bergendal occurring in Port Phillip Bay, Victoria—the authenticity of this record has always been doubted by subsequent writers, even by Laidlaw himself.

The examination of the above-mentioned material has been carried out on whole specimens cleared in methyl salicylate and on longitudinal serial-sections of copulatory complexes cut at 10 μ m and double-stained with haemalum and eosin. For the preparation of the serial sections, the writer would like to thank Mr D. W. Cooper of the Histology Section of the British Museum (Natural History).

Deposition is in the Australian Museum, Sydney, Australia (AM); British Museum (Natural History), London, England (BM); National Museum of Victoria, Melbourne, Australia (NMV); and South Australian Museum, Adelaide, Australia (SAM).

List of Species

From South Australia

Discocelis australis Hyman
Enterogonia orbicularis (Schmarda)
Ancoratheca australiensis Prudhoe
Notoplana australis (Schmarda)
Notoplana longicrumena Prudhoe
Planocera edmondsi Prudhoe
Echinoplana tenerrima Haswell
Cestoplana meridionalis Prudhoe
Pseudoceros reticulatus Yeri and Kaburaki
Pseudoceros lividus sp.nov.
Notoplana distincta sp.nov.
Tripylocelis typica Haswell
Thysanozoon skottsbergi Bock
Cycloporus australis Prudhoe

From Victoria

Latocestus sp.innom.
Euplana gracilis (Girard)
Candimoides cuneiformis gen. et sp.nov.
Hoploplana rosea Prudhoe

From Tasmania

Planocera edmondsi Prudhoe
Pseudoceros reticulatus Yeri and Kaburaki

SYSTEMATICS

Family DISCOCELIDIDAE Laidlaw, 1903, emended
 Poche, 1926

Discocelis australis Hyman, 1959

Locality: South Australia—one specimen (accidentally destroyed) under rocks, West Is., S.A., Shepherd, 29.v.73.

Morphology: Broadly oval in outline, firm consistency, about 18 mm long and about 12 mm maximum width, which occurs in cephalic region. Ground colour greyish white with tinge of brown along median line on the dorsal surface. Surface also bears many scattered dark brown spots, so evident in most species of *Discocelis* Ehrenberg. Cerebral organ situated at about 4 mm from anterior margin of the body and near anterior end of pharynx. Eyes in region of cerebral organ, arranged more or less in two elongate clusters representing cerebral eyes. Tentacular eyes lie more dorsally than cerebral eyes and disposed in two rounded groups, laterally to cerebral eye-clusters. Numerous very small anterior marginal eyes distributed in two or three irregular rows which extend posteriorly to level of tentacular eyes. Distribution of eyes precisely as figured by Hyman (1959). Mouth opens into posterior region of the pharyngeal chamber, at about 7 mm from hinder margin of body; common genital pore about 3 mm posterior to mouth.

As seen in the whole specimen cleared in methyl salicylate, the copulatory complexes, although not fully developed, closely resemble those described and figured by Hyman for *Discocelis australis*, originally collected at Long Reef, near Sydney, N.S.W.

Family LATOCESTIDAE Laidlaw, 1903

Latocestus sp.innom.

Locality: Victoria—one fragmentary juvenile specimen (NMV/G3292), Crib Point Benthic Survey; Stn. 41 N/5, Westernport, date unknown.

Morphology: Elongate, about 5 mm long, brownish dorsally and ventrally. Eyes spread fanwise over cephalic region and marginal eyes form complete series round body.

Remarks: The genus *Latocestus* Plehn has not been recorded hitherto from Australia, but it is widely distributed in the tropical and temperate regions of the Atlantic and Indo-Pacific Oceans. Of those species recorded from the Indo-Pacific region, the present form bears some resemblance to *L. argus* Laidlaw and *L. maldivensis* (Laidlaw) in the coloration of the body and in the distribution of the eyes.

Family STYLOCHIDAE Stimpson, 1857

Enterogonia Haswell, 1907

Diagnosis: Stylochidae with rudimentary tentacles. Marginal eyes in complete series around body; cerebral eyes merge with frontal eyes to spread fanwise anteriorly and join with marginal eyes; tentacular eyes located nearer dorsal surface than cerebro-frontal eyes. Genital pores well separated. Pair of vasa deferentia unite to form ejaculatory duct; no seminal vesicle. Prostatic organ very small and "free". Penis-papilla thick, unarmed. Vagina long, forming anteriorly-directed loop from female antrum. Vagina terminating in genito-intestinal canal.

Type-species: *E. orbicularis* (Schmarda, 1859)
 Stummer-Traunfels, 1933.

Type-locality: although originally recorded from the Chilean coast, Stummer-Traunfels states that there is evidence that Schmarda's specimens were collected in New Zealand.

Remarks: The diagnosis of *Enterogonia* by Hyman (1959) is modified mainly because of a reinterpretation of the structure of the reproductive system (see morphology of *E. orbicularis*).

Enterogonia orbicularis (Schmarda, 1859)

Synonymy: *Polycelis orbicularis* Schmarda, 1859; *Enterogonia pigrans* Haswell, 1907; *Enterogonia pigrans* var. *novaezealandiae* Bock, 1925; *Enterogonia orbicularis* Stummer-Traunfels, 1933; *Enterogonia pigrans* Hyman, 1959; *Enterogonia orbicularis* orbi-

cularis Hyman, 1959; *Enterogonia orbicularis pigrans* Hyman, 1959.

Diagnosis: Fleishy forms, oval or elliptical in outline, varying from 10-34 mm long and 5-23 mm wide. Dorsal surface greenish, pale olive-green, dark grey or light brown, often with numerous greenish brown, dark olive or brownish spots. Nuchal tentacles scarcely noticeable. Anteriorly-extending cerebral eyes commence behind cerebral organ. Mouth situated centrally; elongate pharynx in middle third of body, with 10-12 pairs of lateral folds. Long, narrow, ejaculatory duct opening into narrow male antrum through unarmed penis-papilla. Epithelial lining of "shell"-chamber thrown into a spiral fold.

Localities: South Australia—2 specimens (SAM/V2631-V2637 consisting of uncut portions and serial sections), shore line, Ceduna, B. L. Baker, Nov. 1940; 1 specimen (SAM/V2625-V2630 consisting of an uncut portion and serial sections), Whittlebee Point, W. Zeidler, 2.iii.75; specimens (BM/1980.5.1.25), under stones, upper tidal zone, Port Noarlunga, St Vincent Gulf, S. J. Edmonds, 24.x.53 and on Aldinga Reef, St Vincent Gulf, S.A. Shepherd, 2.ix.72; specimens (BM/1980.5.1.29), Japanese oysters, Coffin Bay, near Port Lincoln, S.A. Shepherd, date unknown; specimen (BM/1980.5.1.30), south side of Salt Creek, Tumby Bay, Spencer Gulf, S. J. Edmonds, date unknown.

Morphology: The above specimens from South Australia, measuring 9-22 mm in length, possess a very small "free" prostatic organ and agree exactly with that described by Bock (1925) and Stummer-Traunfels (1933) in the New Zealand material. This organ may be interpreted as a small swelling arising from the dorsal wall of the ejaculatory duct, where the duct turns ventrally to enter the penis-papilla. It is lined with a glandular epithelium provided with long cilia and coated with a musculature distinctly thicker than that in the wall of the ejaculatory duct. Neither Haswell (1907) nor Hyman (1959) appear to have recognized this organ in specimens from N.S.W. Hyman (Fig. 18) depicts a dilation of the ejaculatory duct and a thickening of its muscular wall ("a curved chamber") immediately before the duct turns ventrally, and it seems possible that she mistook the insignificant prostatic organ merely as a swelling of the ejaculatory duct. Moreover, in the present material, where the prostatic organ opens into the ejaculatory duct, the latter is provided with a relatively thick musculature and further suggests that the male complex in the material examined by Haswell and Hyman might not have been fully developed.

Remarks: These worms appear to associate with colonies of bivalve molluscs, but there is no direct evidence that they are predatory on the colonies, even though they undoubtedly scavenge among them by

feeding on dead or injured animals. *E. orbicularis* seems to be one of the better known Australian polyclads, for Haswell (1907) and Hyman (1959) described it from N.S.W. under the name *Enterogonia pigrans*, and Bock (1925) described specimens from New Zealand and considered them to be so very closely related to Haswell's form that he gave them the name *Enterogonia pigrans* var. *novaezealandiae*. Stummer-Traunfels (1933) redescribed Schmarda's (1859) original material of *Polycelis orbicularis* from New Zealand and considered it to be identical with *E. pigrans* var. *novaezealandiae* Bock. The main differences between the specimens from New Zealand and those from Australia are found in the greater size (26-34 mm in length of the former and 10-15 mm in the latter) and the supposed absence of a prostatic organ in the latter. In addition to these features, Hyman (1959) stated that the New Zealand form differed from the Australian one in its less roomy male antrum, in the larger penis-papilla, and in the lack of an expanded lumen in the distal region of the vagina. Bock (1925) rightly discounts the difference in size as a specific character. Concerning the differences listed by Hyman, with the exception of the prostatic organ, they are merely variations influenced to a more or less degree by size and may be considered as superficial and of no diagnostic importance.

ANCORATHECA Prudhoe, 1982

Diagnosis: Stylochidae with oval body. From anterior end of pharynx, cerebro-frontal eyes spread fan-wise over cephalic region; tentacular eyes in two small groups among cerebro-frontal eyes; marginal eyes variably distributed. Genital pores adjacent. Accessory and true seminal vesicles together forming trilobed or anchor-shaped structure; prostatic organ muscular, elongate, with narrow lumen and smooth epithelial lining; penis-papilla bearing short stylet, lying in penis-pocket opening into male antrum through shallow penis-sheath. Vagina simple, terminating in Lang's vesicle sometimes opening on ventral surface of body.

Type-species: *Ancoratheca australiensis* Prudhoe, 1982

Other species: *A. pacifica* (Bock, 1923).

Remarks: The single specimen of *A. australiensis* described below is grouped in the Stylochidae because of the distribution of the eyes, the long pharynx and the posterior positions of the copulatory complexes. It bears a strong resemblance to *Neostylochus pacificus* Bock 1923, from Juan Fernandez Is. off the coast of Chile. This similarity with *N. pacificus* seems to indicate that the latter is not congeneric with the type species of *Neostylochus* (*N. fulvopunctatus* Yeri and Kaburaki 1918) from Japan. For instance, *N. fulvopunctatus* possesses a simple, elongate seminal vesicle and a vagina bulbosa, whereas *N. pacificus*

and *A. australiensis* have a trilobed seminal vesicle and no vagina bulbosa, differences which are here regarded as generically important. Therefore, the latter 2 species are grouped in *Ancoratheca*.

Ancoratheca australiensis Prudhoe, 1982

(Fig. 1)

Locality: South Australia—holotype (SAM/V2608-V2612, consisting of an uncut portion and serial sections), 15 metres deep, Upper Spencer Gulf, S.A. Shepherd, 5.ix.73.

Morphology: Fleshy, somewhat oval in outline, rounded anteriorly, tapering posteriorly, and of firm consistency. About 10 mm long and up to 6 mm wide. Dorsal surface of body (when preserved in alcohol) buff-coloured, dappled with dark spots, due to underlying gonads, except anteriorly and marginally, where body is somewhat lighter in colour. No tentacles. Very small marginal eyes disposed in three to five irregular rows and confined to about anterior third of total length of body. Cerebral organ somewhat bilobed. At about 3.5 mm from anterior margin, further minute eyes spread fanwise over the cephalic region to merge with marginal eyes and may be regarded as cerebro-frontal eyes. Among these, a short distance anteriorly to the cerebral organ, there is a cluster of a few eyes on either side of the median line. These are nearer to dorsal surface of the body and may be regarded as small clusters of tentacular eyes.

Pharynx narrow, about 6 mm long, mainly in posterior half of body; shows no lateral folds, only a slight rippling of lateral margins. Mouth opens into hinder region of pharyngeal chamber. Numerous intestinal branches extend to the periphery of body and do not appear to anastomose.

Genital pores very close together and appear to open into a short narrow genital atrium or a depression in the body-wall, lying at about 2.5 mm from posterior margin of the body. Near posterior end of the pharynx, the vasa deferentia become exceedingly muscular and form a pair of elongate accessory seminal vesicles which are directed postero-dorsally above 'genital atrium.' These open directly into a muscular seminal vesicle directed antero-ventrally, parallel with, and to left side of, accessory vesicles. Prostatic organ elongate and lies parallel with, and close to right side of, accessory seminal vesicles. It is invested with very thick musculature consisting of an outer layer of circular fibres and a doubly thick inner layer of longitudinal fibres. Through these layers the efferent ducts of extracapsular gland-cells pass to open into narrow lumen of prostatic organ. Latter lined with a shallow glandular epithelium, which shows no radial or longitudinal folding. Short muscular ejaculatory duct extends from seminal vesicle uniting with a muscular prostatic duct and enters very small mus-

cular penis-papilla, armed with a short stylet. This lies in a small penis-pocket, which opens into a small antrum masculinum through a shallow penis-sheath.

Female antrum short and narrow, leading into a relatively wide vagina lined with an exceptionally tall ciliated epithelium. Numerous 'shell'-glands open into a short portion of distal half of vagina to form a 'shell' chamber, epithelium of which appears to be thrown into four or five spiral folds. From 'shell'-chamber, vagina extends posteriorly for a short distance to receive short common duct of uterine canals. From this union, vagina interna continues posteriorly to open into a spacious arcuate Lang's vesicle through a sphincter. Inner end of vesicle narrows considerably to open to exterior through a tiny pore situated at about 0.5 mm posterior to common genital opening. The epithelium of the proximal region of the vagina interna is thrown into radial folds, a feature commonly associated with the 'stalk' of Lang's vesicle. Lang's vesicle is in poor histological condition but it appears as a membranous structure lined with large gland-cells containing a secretion staining weakly with eosin. An interesting feature is that it contains small packets of spermatozoa, one of which is clustered around the sphincter at the union of the vagina and the vesicle. A few individual spermatozoa are also present in the proximal region of the vagina interna suggesting that fertilization may take place in the uterine canals. Further, it might be thought that the packets of sperm had been deposited through the body-wall by hypodermic impregnation with a penial stylet of another worm, but this does not seem to be so because the wall of Lang's vesicle is fused to the tiny external aperture.

Remarks: *A. australiensis* may be distinguished from *A. pacifica* by the marginal eyes not completely encircling the body and by Lang's vesicle opening on the ventral surface of the body.

The fusion of the musculature of the seminal vesicle (which consists principally of circular fibres) with its accessory vesicles appears to produce a structure similar to the trilobed or tripartite seminal vesicle of the genus *Stylochus* (*Imogine*). The tight clustering together of the organs of the male copulatory complex may not be normal but due to contraction of the hinder region of the body.

The opening of Lang's vesicle directly to the exterior is very interesting, because it could be regarded as the original condition of the ductus vaginalis found in several acotylean polyclads, particularly among species belonging to the family Stylochidae. Bock (1925a), however, assumes that the ductus vaginalis has been derived from the 'stalk' of Lang's vesicle, and he presents evidence to support this assumption, with particular references to *Discocoelides langi* Bergendal, where an accessory canal connects the 'stalk' directly to the antrum femininum. Whilst Bock's

assumption may be justified in some instances, it should not be overlooked that in other instances the ductus vaginalis might also have arisen solely from Lang's vesicle, which having made contact with the exterior, as in the present form, eventually lost its

function solely as a receptaculum seminis and became reduced to a narrow canal for the discharge of waste reproductive materials, as well as for copulation, thus being comparable with Laurer's canal of trematodes and the vagina of cestodes.

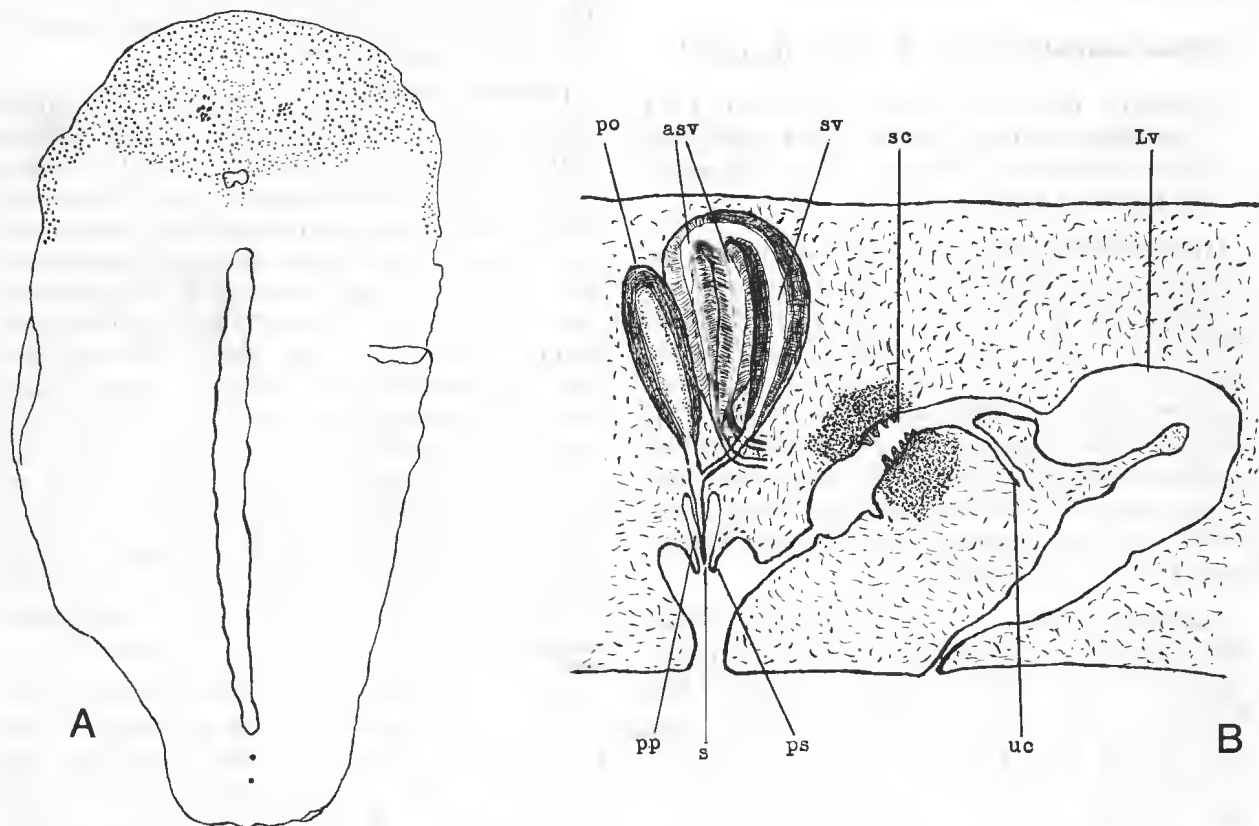


FIG.1. *Ancoratheca australiensis*. A. Dorsal view. B. Sagittal section of copulatory complexes. asv., accessory seminal vesicles; Lv., Lang's vesicle; po., prostatic organ; pp., penis-pocket; ps., penis-sheath; s., stylet; sc., "shell"-chamber; sv., seminal vesicle; uc., common uterine canal

Family LEPTOPLANIDAE Ehrenberg, 1831,
emended Stimpson, 1857

Euplana gracilis (Girard, 1850); Girard, 1895

(Fig. 2)

Locality: Victoria—one damaged specimen and several fragments (BM/1980.5.1.11 and NMV/G3290 and G3291), Port Phillip Bay Environmental Study; Stn. 137/3 and 137/5.

Morphology: Body delicate, elongate-oval; 3.25–5.0 mm long, 0.9–1.75 mm maximum width (measurements are estimates since no specimens complete). In alcohol, dorsal surface yellowish brown with dark brown spots from underlying ovaries; ventral surface greyish. No tentacles. Cerebral organ 0.25 mm from anterior end. Eyes few, in two rows each of 4–5 on either side of cerebral organ. Mouth opens into middle of pharyngeal chamber which lies in anterior half of body closely behind cerebral organ. Pharynx has a few pairs of shallow lateral pockets. Median intestinal

trunk extends from near cerebral organ to posterior region giving off several pairs of lateral branches; these anastomose initially but are free marginally. Male and female genital pores separate and lie in middle region well behind pharynx.

Remarks: Unfortunately, the histological condition of the material does not permit of a precise examination for description, but sufficient has been made out of the reproductive system to show that it is undoubtedly comparable with that described by Hyman (1939) in American specimens.

Euplana gracilis was known hitherto to occur only on the Atlantic coast of North America, where, according to Hyman (1940), it is common in the benthic fauna of the boreal/warm temperate region and ranges from Prince Edward Island, Canada, to the western coast of Florida. Its occurrence in Port Phillip Bay is therefore surprising, and it must be assumed that the worm had somehow been transported from America, possibly when eggs attached to the

hull of a ship hatched in Victorian waters. There is also the possibility that they were carried with oysters or other animals and deposited in these waters. Bennett and Pope (1960) apparently regard the Victorian coast as a cold-temperate region, and it seems therefore to be a suitable area for *Euplana gracilis*—clearly a eurythermic species—to establish itself.

Notoplana australis (Schmarda, 1859) Bock, 1913

Synonymy: *Polycells australis* Schmarda, 1859; *Leptoplana australis* Laidlaw, 1904; *Leptoplana suteri* Jacobowa, 1906; *Notoplana australis* forma *huina* Marcus, 1954.

Diagnosis: Body elongate oval, of variable size and coloration. Nuchal tentacles rudimentary or not apparent. Eyes of the cerebral groups smaller than the tentacular eyes. Mouth in middle region of body; pharynx with 12-17 pairs of lateral folds. Genital pores well separated. Seminal vesicle smaller than prostatic organ, which has six epithelial longitudinal chambers. Penis-papilla very small and provided with a long stylet enclosed in elongate muscular penis-pocket. Antrum masculinum narrow. Vagina bulbosa large; Lang's vesicle elongate.

Localities: South Australia—specimen (SAM/V2638-V2645—consisting of uncut portions and serial sections), near Jones Island, Baird Bay, W. Zeidler, 27.ii.75; specimen (SAM/V2646) under rocks at low tide, Daly Head, Yorke Peninsula, W. Zeidler, 9.xi.76; specimen (SAM/V2647) Brown Point, W. Zeidler, 9.viii.74; 2 specimens (SAM/V2648 and V2649), Wittelbee Point, near Ceduna, W. Zeidler, 2.iii.75; specimen (SAM/V2650) under intertidal rocks, Pondalowie Bay, W. Zeidler, 9.xi.76; specimen (BM/1980.5.1.8), Wittelbee Point, near Ceduna, W. Zeidler, 2.iii.75; specimen (BM/1980.5.1.9, in part), under rocks, upper tidal zone, American River Inlet, Kangaroo Island, S. J. Edmonds, Aug. 1946; specimen (BM/1980.5.1.9, in part) under rocks, upper tidal zone, Port Noarlunga, St. Vincent Gulf, S. J. Edmonds, November 1950; specimen (BM/1980.5.1.10), under stones, 5 metres of water, Tipara Reef, Spencer Gulf, S.A. Shepherd, 25.v.73.

Morphology: This species has been adequately described by Haswell (1907), Bock (1913) and Stummer-Traunfels (1933). It seems to be exceedingly variable in size. Existing records give the size of preserved adult worms as 19-37 mm long and 9-20 mm wide, but Haswell records specimens up to about 76 mm in length when alive. Present adult specimens are 15-32 mm long and 7-15 mm wide; one immature specimen is 20 mm long and 9 mm wide. Haswell also records small sexually mature specimens under 10 mm in length from New Zealand and suggests that they may be a dwarf variety of *N. australis*. Among the present material, a specimen from Baird

Bay measures only 9 mm in length and 4 mm in maximum width, but although it has both sets of copulatory complexes there is no indication of developing ova. Marcus (1954) recorded a similar form from the coast of Chile and named it *Notoplana australis* forma *huina*, which he regarded as distinct from the dwarf form of Haswell and listed two or three morphological differences, but these appear to have no systematic importance.

The coloration of the dorsal surface of this polyelad varies greatly from almost black, through differing shades of brown, to orange; Hyman (1959) records specimens of olive-grey or greenish grey. The present adult specimens are greyish with an elongate-oval central area of pale brown; immature specimens a dull white with a tinge of brown in the pharyngeal region. The ventral surface of mature and immature worms is always somewhat lighter. The specimen from the Tipara Reef was originally orange coloured, mottled with white above and below. The dorsal surface also had a dark brown median band, due to the underlying pharynx, and the shallow nuchal tentacles were also of an orange colour with a whitish apex and a band of white about midway along each tentacle. The area around the base of each tentacle is without colour. After prolonged immersion in an alcohol preservative, this specimen has lost such coloration.

On the dorsal surface, at about the junction of the first and second quarters of the total length of the body, Haswell mentions the presence of "two clear colourless rounded knobs on which tentacular groups of eyes are borne." In the present specimens one may occasionally distinguish a pair of very shallow bosses, representing rudimentary tentacles, but in their place in other specimens there may be a pair of clear roundish areas in the region of the cerebral organ and in them lie tentacular eyes. Laidlaw (1904) and Jacobowa (1906) found rudimentary tentacles in specimens from Australia. In Chilean specimens, Marcus found rounded bosses as nuchal tentacles, which were transparent in the living animal.

The pharynx lies in the middle third of the body and possesses from 8 to 15 pairs of lateral folds. The main intestine has 12 to 15 pairs of lateral branches, which ramify towards the periphery of the body and appear to anastomose only in the pharyngeal region—a feature to be seen in other species of the genus *Notoplana* Laidlaw. In the posterior region of the pharynx, the main intestine bifurcates and the arms pass round the copulatory complexes, similarly, the anterior end of the intestine bifurcates and the limbs pass round the cerebral organ.

The structure of the copulatory complexes has been sufficiently described by Haswell (1907) and well figured by Bock (1913), Marcus (1954) and Hyman (1959) in sagittal or longitudinal section. The pros-

tatic organ in the present material agrees with that described by Laidlaw (1904) in having its epithelial lining modified into six longitudinal chambers.

Remarks: *Notoplana australis* is evidently a common and widely distributed species on the southern coasts of Australia. In addition to the present material from various localities on the South Australian coast, this species has been recorded from Port Phillip, Victoria, by Laidlaw (1904), from Tasmania by Haswell (1907) and from N.S.W. by Schmarda (1859), Haswell (1907), Stead (1907), Boek (1913) and by Hyman (1959). It has also been recorded from New Zealand in various localities extending from Lyttleton Harbour northwards to Auckland Harbour by Schmarda (1859), Jacobowa (1906) and by Haswell (1907). Latterly, it has been recorded from the coast of Chile between 20°S and 41°S by Marcus (1954).

Stead (1907) reported the destruction of oyster-beds by "*Leptoplana*" *australis* in N.S.W. While circumstantial evidence might point to this, it is more likely that some other factor was responsible, and that the polyclads were merely engaged in cleaning up by devouring dead and injured animals. In fact, Stead speaks of the abundance of a polychaete predator and the oyster-drill *Urosalpinx* among the oysters.

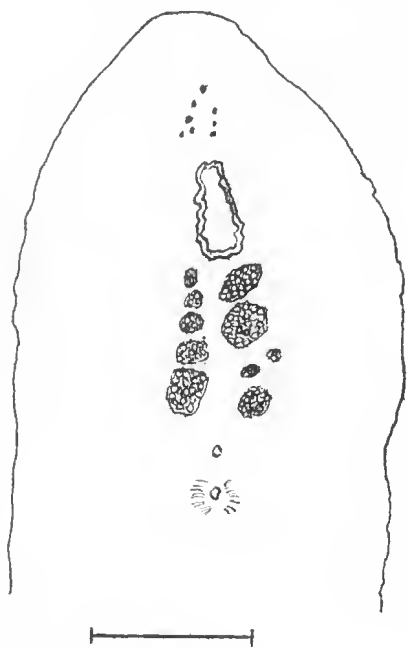


FIG. 2. *Euplana gracilis*. Anterior half of body, dorsal view (bar-scale=0.5 mm.)

Notoplana distincta sp. nov.

(Fig. 3)

Diagnosis: Body elongate oval, 21.5 mm long and pale yellowish brown. Eyes in two elongate cerebral clusters. Mouth anterior to middle of body; pharynx with 8 or 9 pairs of lateral folds. Genital pores well

separated. Seminal vesicle larger than prostatic organ, which has four longitudinal epithelial chambers. Penis-papilla in the form of a long stylet entirely enclosed in penis-pocket. Antrum masculinum long and narrow, lined with tall glandular epithelium thrown into longitudinal folds. Antrum femininum narrow, lined with glandular epithelium; Lang's vesicle small and bulbous.

Locality: South Australia—holotype (BM/1980.5.1.5), under rock, upper tidal zone, Port Noarlunga, Gulf St Vincent, S. J. Edmonds, Nov. 1950.

Morphology: Rounded anteriorly and tapering posteriorly. Length, 21.5 mm; maximum width, 6 mm, which occurs in the mid-region of the body. Dorsal surface is pale yellowish brown. The cerebral organ lies at about 4 mm from the anterior margin of the body. Eyes are arranged in two elongate groups on either side of the median line in the region of the cerebral organ. There are 36 to 50 eyes in each group, and in the hinder region of each group, on the posterolateral borders of the cerebral organ, lie 12 to 16 larger eyes more dorsally situated and represent the tentacular eyes, although tentacles are absent.

The dorsal musculature of the body-wall is, as usual in polyclads, less well developed than the ventral musculature, but the basement membrane of the dorsal wall is about twice as thick and the epithelium taller than that of the ventral wall.

The mouth lies at about 5 mm posteriorly to the cerebral organ and a little behind the middle of the pharyngeal chamber. The pharynx is situated a little anteriorly to the middle of the body and measures 3.5 mm long. It possesses 8 or 9 pairs of lateral folds. The intestinal branches appear to anastomose in the pharyngeal region and terminate trichotomously in the marginal zones of the body.

The male genital pore is situated in the central region of the body, 3.5 mm posteriorly to the mouth, and the female pore 1 mm behind the male and about 8 mm from the posterior end of the body.

The testes are scattered in the ventral parenchyma, as far as the submarginal zones of the body. The vasa deferentia arise on either side of the pharynx and extend posteriorly to a level close behind the female genital pore, where they turn inwardly to unite in the median line to form a posterior loop. About midway along their length, each vas deferens gives off a medially-directed branch, which becomes much convoluted and swollen with sperm. These two branches open independently into a muscular pyriform seminal vesicle, the narrow end of which is directed anteriorly. From the narrower end of the seminal vesicle, a short ejaculatory duct runs dorsally to lead into a globular prostatic organ provided with a relatively thick muscular wall. The ejaculatory duct passes well into the

prostatic organ and is surrounded by a tall glandular epithelium, in which there are four tubes lying parallel with the ejaculatory duct. The epithelial tubes and the ejaculatory duct open into a small chamber in the distal region of the prostatic organ. From this organ, the ejaculatory duct turns posteriorly to enter an elongate penis-papilla. The papilla is covered with a membrane or perhaps a thin cuticle and lies entirely

within a penis-pocket. The proximal half of the penis-pocket encloses the papilla and is lined with a membrane or cuticle, similar to that covering the penis-papilla, whereas the distal half of the penis-pocket is lined with tall cilia. Through a shallow penis-sheath, the pocket opens into a long narrow antrum masculinum lined with a tall glandular epithelium thrown into longitudinal folds.

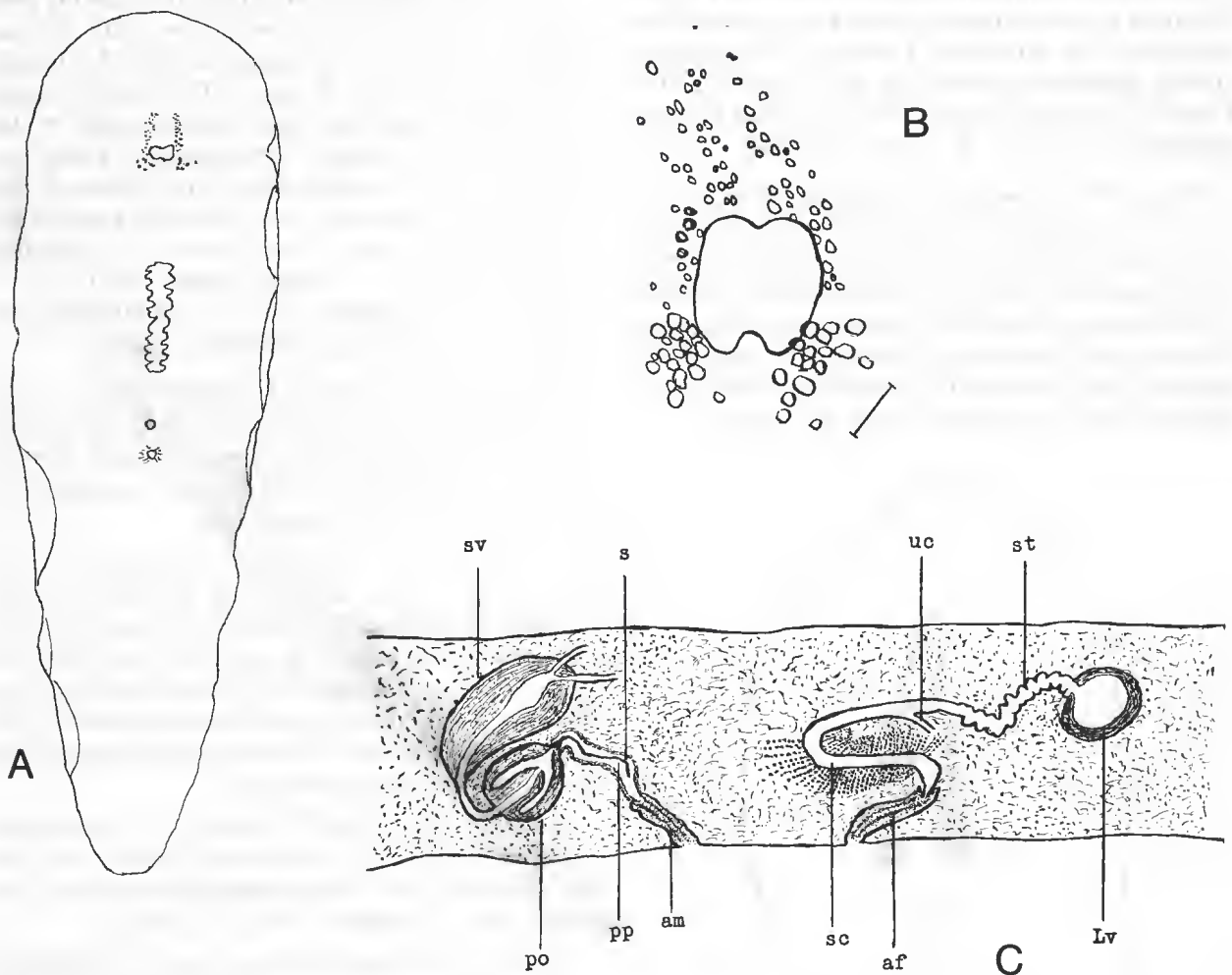


FIG. 3. *Notoplana distincta*. A. Dorsal view. B. Arrangement of eyes (bar-scale=0.2 mm.) C. Sagittal section of copulatory complexes. af., antrum femininum; am., antrum masculinum; Lv., Lang's vesicle; po., prostatic organ; pp., penis-pocket; s., stylet; sc., "shell"-chamber; st., stalk of Lang's vesicle; sv., seminal vesicle; uc., common uterine canal.

The dorsally-disposed ovaries are numerous and widely scattered, extending farther into the submarginal zones of the body than the testes. The uterine canal on the right side of the pharynx extends anteriorly a little beyond the pharynx, whereas that on the left side appears to be malformed, for it is thrown into several coils alongside the hinder margin of the pharynx. The posterior ends of the two uterine canals unite to form a short common duct opening into the vagina at the union of the vagina interna and the

"stalk" of Lang's vesicle. The epithelium of the "stalk" is thrown into radial folds, so that the lumen appears moniliform in longitudinal section. Lang's vesicle is small and lies at a level a little posteriorly to the female genital pore. It is lined with a highly glandular epithelium and coated with a relatively thick musculature. From the uterine opening, a short vagina interna extends anteriorly to enter a narrow "shell"-chamber, which soon turns ventrally to run posteriorly to a point ventrally to the union of the uterine canals,

where it curves ventrally to open into the antrum femininum through a distinct conical papilla. The "shell"-chamber is heavily invested with "shell"-glands and lined with an epithelium bearing tall cilia. The antrum femininum is narrow and lined with a tall glandular epithelium.

Remarks: The features of this new species are the forward position of the pharynx, the wide separation of the male copulatory complex from the posterior end of the pharynx, the widely-separated genital pores in the middle third of the body and the glandular nature of the male and female antra. A further feature is the conical papilla through which the "shell"-chamber opens into the antrum femininum, but this structure is unusual among polyelads, and it needs to be confirmed as a characteristic of the species.

Notoplana longicrumena Prudhoe, 1982

(Fig. 4)

Diagnosis: Body elongate oval in outline, up to 25 mm in length; dorsal surface yellowish grey, tinged with brown along median line; ventral surface greyish. No nuchal tentacles. Eyes in two elongate groups. Mouth centrally situated; pharynx with about 9 pairs of lateral folds. Genital pores separated. Seminal vesicle more or less as large as prostatic vesicle, which has five longitudinal epithelial chambers; long penis-papilla in form of stylet projecting well into male antrum, which is narrow and deep. Antrum femininum narrow; Lang's vesicle bulbous.

Locality: South Australia—holotype (SAM/V2651—V2665—consisting of uncut portion and 14 slides of serial sections), Point Brown, W. Zeidler, 9.viii.74.

Morphology: It is elongate oval in outline, rounded at both ends and measuring 25 mm long and 10 mm wide. Its dorsal surface is yellowish grey, with a tinge of brown in the middle region, while its ventral surface is greyish. There is no indication of nuchal tentacles. The mouth is centrally placed and opens into the middle region of the pharyngeal chamber, which holds a pharynx measuring about 6 mm in length and possessing about 9 pairs of lateral folds.

Eyes are disposed in two elongate groups extending anteriorly for about 1 mm from the cerebral organ, which is situated at about 5 mm from the anterior margin of the body. The two groups of eyes tend to converge gradually as they move forward from the cerebral organ, and each group consists of cerebral and tentacular eyes, the latter being larger, nearer to the dorsal wall of the body and laterally to the cerebral organ and hinder cerebral eyes.

The dorsal epithelium of the body is higher than the ventral epithelium, and the musculature of the ventral wall is two to three times deeper than that in the dorsal wall.

The male genital pore is situated 4 mm posteriorly to the pharynx and the female pore 0.8 mm behind the male. A pair of convoluted vasa deferentia originate in the ventral parenchyma on either side of the median line, close behind the pharynx. They extend posteriorly to about level with the male genital pore, where they turn inwardly to open quite independently of each other, into the seminal vesicle. There is no indication of branches to the vasa deferentia extending posteriorly and uniting behind the vagina, as found in other species of *Notoplana*. The seminal vesicle is pyriform and possesses a well-developed musculature of circular fibres. Its narrow end is directed anteriorly. The globular prostatic organ lies dorsally to the distal end of the seminal vesicle and is thickly coated with circular and mainly longitudinal muscle fibres, investing a tall glandular epithelium. From the distal end of the seminal vesicle, a short ejaculatory duct extends dorsally to penetrate some way into the prostatic organ, the epithelium of which envelops the duct and contains five elongate compartments lying parallel with the duct. The compartments and the duct open together into a small chamber in the distal part of the prostatic organ. From the latter, the ejaculatory duct leads into a relatively long slender penis-papilla coated with a cuticle and may be regarded as a stylet, which projects into the male antrum through a long convoluted penis-pocket with no sign of a penis-sheath. The penis-pocket is lined with a ciliated epithelium coated with a thin musculature invested by a thickened parenchyma. The male antrum is deep and narrow, and lined with an epithelium continuous with that of the ventral wall of the body.

The female genital pore leads into a narrow and shallow antrum femininum or vagina externa, which extends dorsally to open into the vagina media. The inner two-thirds of the vagina media is surrounded by numerous "shell"-glands and functions as a "shell"-chamber. This chamber extends to the dorsal wall of the body, where it turns posteriorly to open into the vagina interna. This region of the vagina continues posteriorly to open into a bulbous Lang's vesicle. Shortly before opening into Lang's vesicle, the vagina receives the common duct of the two uterine canals. Anteriorly, the uterine canals are confluent in front of the pharynx. The vagina is coated with a musculature of longitudinal and circular fibres and lined with a ciliated epithelium, whereas Lang's vesicle is lined with a shallow glandular epithelium.

Remarks: Many species have been assigned to the genus *Notoplana* Laidlaw and about 10 of these have, like the present form, no tentacles, a relatively large Lang's vesicle, and a long penis-pocket enclosing a long slender penial stylet. *N. longicrumena* differs

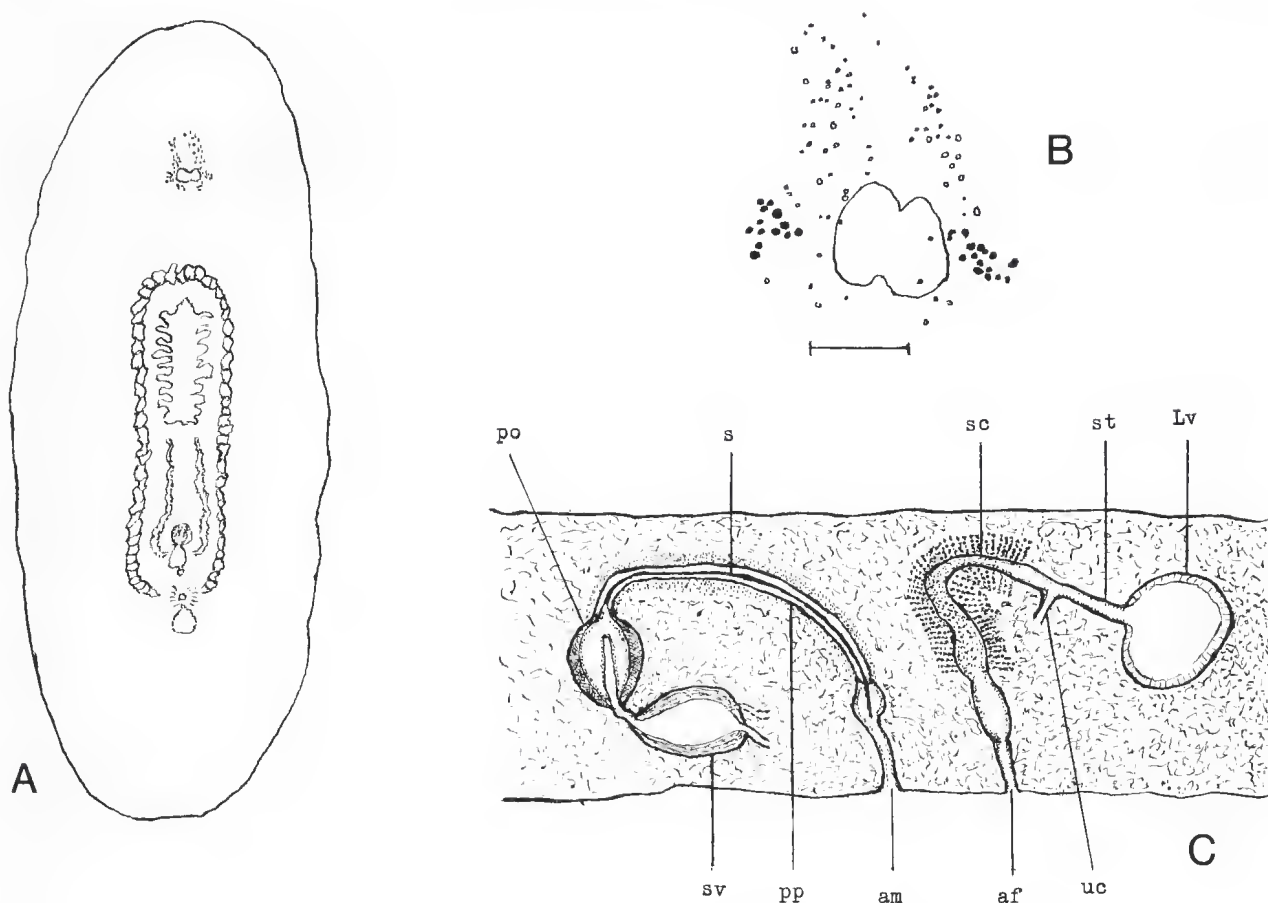


FIG. 4. *Notoplana longicrumena*. A. Dorsal view. B. Arrangement of eyes (bar-scale=0.5 mm.) C. Sagittal section of copulatory complexes. *af.*, antrum femininum; *am.*, antrum masculinum; *Lv.*, Lang's vesicle; *po.*, prostatic organ; *pp.*, penis-pocket; *s.*, stylet; *sc.*, "shell"-chamber; *st.*, stalk of Lang's vesicle; *sv.*, seminal vesicle; *uc.*, common uterine canal.

principally in the comparatively long penis-pocket, which measures about the combined length of the seminal vesicle and prostatic organ, whereas in other species the length of the penis-pocket is only as long as one or other of these organs. Of the species of *Notoplana* possessing a long slender penis-papilla covered with a thin cuticle and lying in a long penis-pocket, the present form closely resembles *N. sawayai* Marcus, 1947, from Brazil and *N. parvula* Palombi, 1924, from Indonesia. Both of these latter forms, however, possess a vagina bulbosa, which is absent in *N. longicrumena*. This species also closely resembles the foregoing *N. distincta*. It differs, however, in the arrangement of the eyes, in the position of the mouth and pharynx, in the relative length of the penial stylet and in one or two other less important features.

Tripylocelis typica Haswell, 1907

(Fig. 5)

Locality: South Australia—a mature and an immature specimen (SAM/V2667), Wittelbee Point, West Coast, W. Zeidler, 2.iii.75.

Morphology: The mature specimen is elongate oval and measures 12 mm long by 5 mm wide. Dorsally,

the body is light brown, ramified with a darker colouration, due to the dark green lining of the gut branches, but in the immature specimen the greenish ramification is apparent only in the pharyngeal region. The ventral surface is of a lighter colour.

A pair of nuchal tentacles occurs at about 1.5 mm from the anterior extremity of the body. About 15 eyes lie on one tentacle and about 19 in the other. The cerebral organ lies in the median line, between the tentacles, and around it cerebral eyes are arranged in two groups.

The mouth is situated in the middle region of the body. The pharynx is about 4 mm long and lies in the middle third of the body. It possesses 9 to 10 pairs of lateral folds. The intestinal trunk is about as long as the pharynx and has 9 or 10 pairs of lateral limbs, which branch towards the margins of the body and do not anastomose. The trunk bifurcates anteriorly and posteriorly.

The male pore is situated at 3.5 mm from the posterior margin of the body, and the female pore about 1 mm behind the male. As is usual among polyclads, the testes and ovaries are disposed ventrally and dorsally, respectively. The vasa deferentia appear

on either side of the pharynx in the region of the mouth and proceed posteriorly in the ventral parenchyma to a little beyond the level of the hinder end of the pharynx, where they turn inwardly to meet in the median line and lead into a short convoluted ejaculatory duct, directed anteriorly. The duct opens into the inner end of a small, dorso-ventrally elongate, seminal vesicle, differentiated from the ejaculatory duct by a somewhat thicker musculature. The dorsal end of the seminal vesicle narrows and bends posteriorly as the ejaculatory duct is thrown into several coils. This latter portion of the ejaculatory duct is lined with a relatively tall ciliated epithelium and has a very narrow lumen. Finally, the duct enters a well-developed unarmed penis-papilla containing numerous gland-cells, and, as noted by Haswell (1907), this suggested that the distal region of the ejaculatory duct might have a prostatic function. The penis-papilla appears as an evagination of the inner end of the long, convoluted, posteriorly directed antrum masculinum, for its epithelial covering is similar to the lining of the male antrum. This epithelium is highly glandular and bears very long cilia. Almost throughout its length, the lumen of the male antrum holds accumulations of an eosinophilous granular material, an indication that the gland cells of the epithelial lining possibly produce a prostatic substance.

The female pore leads into a short narrow antrum femininum, directed dorsally. The antrum opens into a narrow vagina media extending anteriorly to near the male antrum, where it loops dorsally and runs posteriorly to a region above the female antrum. In this region the vagina turns ventrally to receive the common duct of the 2 uterine canals. The vagina media represents that portion of the vagina extending from the female antrum to near the entrance of the common uterine duct. This portion has plicate walls lined with a ciliated epithelium, and into its lumen open the ducts of innumerable extracapsular "shell"-glands investing its entire length, and for this reason the vagina media may be regarded as a long narrow "shell"-chamber. From the latter, the vagina interna, lined with well-developed ciliated cells, continues to the point where it turns ventrally. At this point, after receiving the common uterine canal, the vagina interna gives rise to a ductus vaginalis which extends ventrally to open into the ectal region of the female antrum. The ductus vaginalis is lined with a tall ciliated epithelium, similar to that lining the vagina externa and the uterine canals. On leaving the vagina interna, the uterine canals run alongside the pharynx to near its anterior extremity, where their ends remain separated. From its union with the vagina interna, the lumen of the ductus vaginalis gradually narrows, presumably contracting to prevent the flow of eggs not covered with "shell" material, but used for the expulsion of excess reproductive materials and as a copulatory organ, corresponding to Laurer's canal in trematodes

and the vagina in cestodes, as suggested by Haswell.

Remarks: The mature specimen described above agrees very well with *Tripylocelis typica* as described by Haswell (1907) from N.S.W., but differs principally in one feature, for the ductus vaginalis opens into the antrum femininum and not independently on the ventral surface of the body, as Haswell states. This difference is here not regarded as diagnostically important and the present specimen is determined as *Tripylocelis typica* Haswell, 1907. On the other hand, if it were found that the difference in the position of the opening of the ductus vaginalis was constant in specimens from South Australia and N.S.W., then this feature could be regarded as one of systematic interest. Moreover, there are differences in the structure of the male copulatory complex, but these are probably no more than varying stages of development.

CANDIMBOIDES gen.nov

Diagnosis: Leptoplanidae. Body elongate, without tentacles. Eyes in two elongate clusters in region of cerebral organ. Pharynx in middle third of body. Male and female genital pores approximate and well separated from posterior margin of body. Male copulatory complex immediately posterior to pharynx. Vasa deferentia unite to form common duct opening into muscular seminal vesicle. Prostatic organ muscular and lined with tall, smooth, glandular epithelium. Penis-stylet lying in penis-pocket. Female copulatory complex includes bursa copulatrix and Lang's vesicle.

Type-species: *C. rabita* (du B. R. Marcus & Marcus, 1968) comb.nov.

Other species: *C. cuneiformis* sp.nov.

Remarks: Two specimens of this genus are available. Although their copulatory complexes are not yet fully developed and the gonads are not yet ready to begin their reproductive processes, it is possible to recognise that they are closely related morphologically to *Candimba rabita* du B. R. Marcus and Marcus 1968 from the Caribbean island of Curacao. However, the two forms differ from one another in several features, principally in the structure of the copulatory bursa and in the relative positions of the seminal vesicle and the prostatic organ. When du B. R. Marcus and Marcus (1968) considered the species *C. rabita* to be congeneric with the type-species of *Candimba* (*C. divae* Marcus, 1949, from Brazil), they regarded the absence of a bursa copulatrix in the latter to be of no generic importance. There are however, other important features by which the two forms may be differentiated. In *C. divae* the pharynx lies in the anterior third of the body, the genital pores are widely separated, a penis-stylet and a penis-pocket are absent, whereas in *C. rabita* the pharynx lies in the middle third of the body, the genital pores are close to each other, a penis-stylet and a penis-pocket are present.

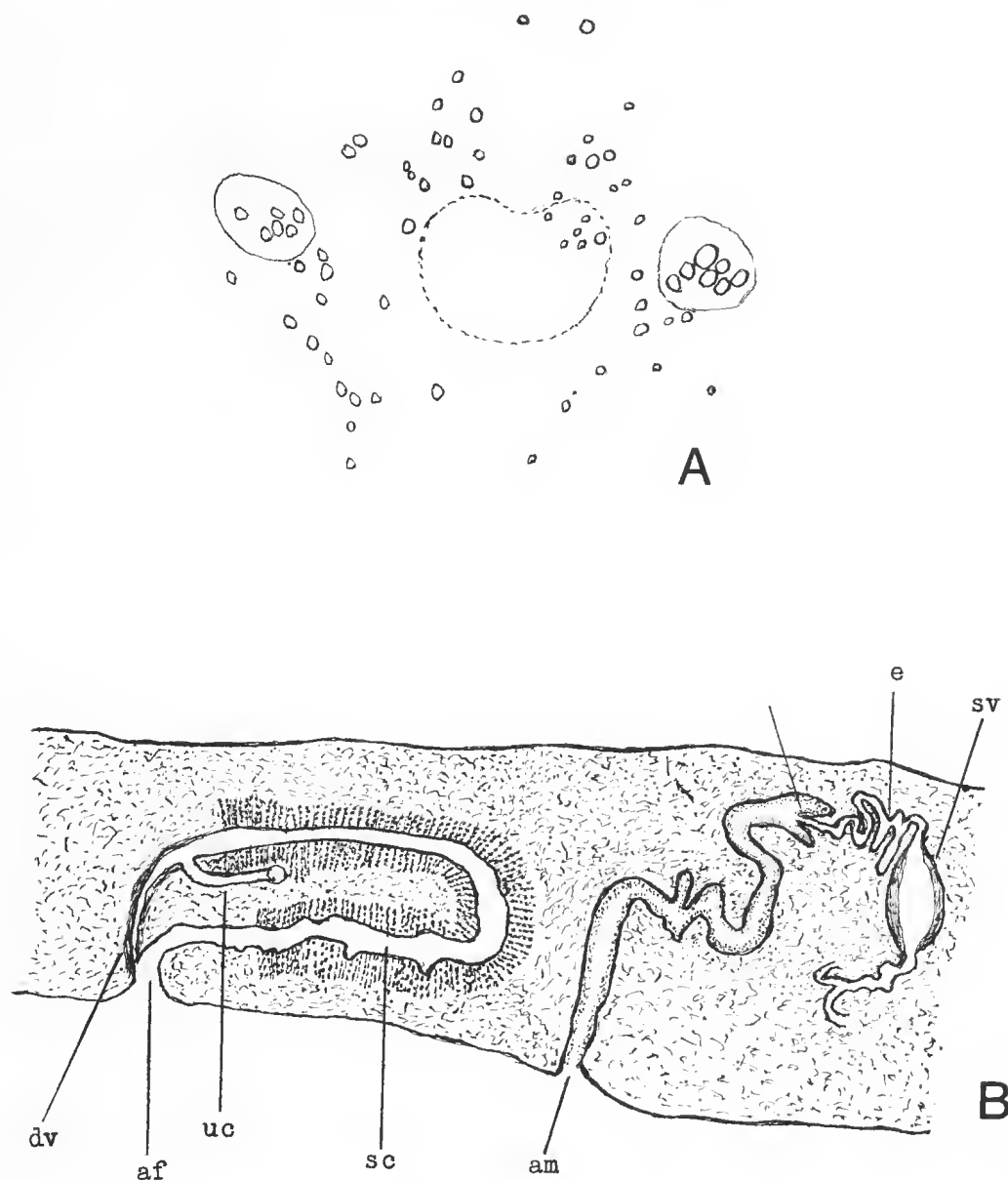


FIG. 5. *Tripylocelis typica*. A. Arrangement of eyes. B. Sagittal section of copulatory complexes. *af.*, antrum femininum; *am.*, antrum masculinum; *dv.*, ductus vaginalis; *e.*, ejaculatory duct; *p.*, penis-papilla; *sc.*, "shell"-chamber; *sv.*, seminal vesicle; *uc.*, common uterine canal.

C. cuneiformis agrees with *C. rabita* in all of these features, and they are both dissimilar from *Candimba divae*, which is the reason for establishing *Candimboides*.

Candimboides cuneiformis sp.nov.

(Fig. 6)

Localities: Victoria—holotype (NMV/G3294), sample M7/1-3, Westernport Bay Environmental Study, Jan., 1974; paratype (BM/1980-5.1.15), sample 32N, Crib Point Benthic Survey, Aug. 1966.

Morphology: The specimen from Westernport Bay is rather distorted and slightly macerated, and that from Crib Point is also in poor histological condition, but apparently both have a somewhat cuneiform outline, rounded anteriorly and tapering posteriorly, and

measure about 6.5 mm long and about 2.5 mm wide. Dorsally, the body is brownish, speckled with dark spots, due to underlying ovaries, which are widely scattered, leaving only the marginal regions free.

The cerebral organ is situated at 1 mm from the anterior margin of the body and bounded by an elongate cluster of eyes on either side. The clusters are short and tend to converge anteriorly. In the specimen from Crib Point there are about 40 eyes in each cluster, whereas in the younger worm from Westernport Bay there are only about 20 eyes in each cluster.

The mouth is situated at about 3 mm from the anterior margin of the body and opens into the middle region of the pharyngeal chamber, which is about 1.5 mm long and contains a short pharynx provided with six pairs of lateral folds. Details of the intestinal

system have not been made out, but the posterior gut branches of the younger specimen appear to be infested with many gregarines.

The hinder half of the specimen from Crib Point has been serially sectioned, and in this specimen the male genital pore is situated at 2.5 mm from the hinder margin of the body, and the female genital pore at 0.3 mm posteriorly to the male pore.

As is usual in polyclads, the testes lie in the ventral parenchyma and the ovaries in the dorsal, with a tendency for the ovaries to move ventrally and mingle with the testes. It has been difficult to make out the vasa deferentia, but they appear to arise in the pharyngeal region and run posteriorly to about the level of the male pore, where they turn inwardly to unite in the median line and form a short anteriorly directed ejaculatory duct. This duct opens into the posterior end of an oval seminal vesicle lying close to the dorsal wall of the body and directed obliquely ventrally. The vesicle is very muscular, its wall consisting of a relatively thick layer of longitudinal and circular fibres. Presumably, the male copulatory complex is not yet fully functional, because the seminal vesicle contains no sperm, but an eosinophilous material similar to that found in the prostatic organ and had probably been forced into the vesicle by contraction of the body at fixation. The anterior end of the seminal vesicle narrows to open into an ejaculatory duct, which curves posteriorly and ventrally to open into the anterior end of the prostatic organ through a shallow papilla. The prostatic organ is oval and lies ventrally to the seminal vesicle, which is of similar size. It is invested with a thick layer of mainly longitudinal muscles, but the portion of the ejaculatory duct passing through the wall of the prostrate is enveloped by a layer of circular muscles, probably functioning as a sphincter. The prostatic organ is lined with a tall, vacuolate, glandular epithelium which produces a granular material. The posterior end of the prostatic organ opens directly into a long slender penis-papilla, the distal two-thirds of which, about 0.35 mm long, is covered with a thick cuticle and may be regarded as a penis-stylet. This stylet appears to be slightly flattened dorso-ventrally to produce an unusual shape, as illustrated (Fig. 6B). It lies in a penis-pocket that opens into a narrow male antrum through a shallow penis-sheath.

The ovaries are widely distributed, extending from level with the eyes to the posterior region of the body. The female pore leads into a narrow antrum. Through the anterior wall of the antrum, near its external aperture, opens a relatively large bursa copulatrix. This bursa is directed dorsally and lies to one side of the median line. The efferent canal of the bursa is exceedingly narrow and invested with compact parenchymatous tissue. Dorsally, it opens into a swollen muscular structure lying above the male pore. In the

present specimen there appears to be little or no lumen to the bursa, until it opens into its bulbous portion, which is provided with a thick muscular wall and lined with a tall ciliated epithelium. From the opening of the bursa copulatrix into the antrum femininum, the vagina extends to near the dorsal wall of the body, where it turns posteriorly and curves ventrally to receive the common duct of the uterine canals. From this union, the vagina continues ventrally to open into a small globular Lang's vesicle. "Shell"-glands are not yet developed, hence a "shell"-chamber is not yet apparent.

Family HOPLOPLANIDAE Stummer-Traunfels, 1933

Hoploplana rosea Prudhoe, 1977

Localities: Victoria—one specimen (NMV/G3293), sample 23S/5, Crib Point Benthic Survey, 1965; one specimen (BM/1980.5.1.21), sample W/1, Westernport Bay Environmental Study, 29.xi.73.

Morphology: The two specimens are discoid and have a diameter of 5-6 mm. The colour of the papillate dorsal surface of the specimen from Crib Point is brownish, instead of pinkish as in the type-specimen of the species from South Australia, while the specimen from Westernport Bay is greyish after preservation in alcohol. The morphology of both specimens appears to be identical with that of the type-specimen.

Family PLANOCERIDAE Stimpson, 1857

Planocera edmondsi Prudhoe, 1982

(Figs. 7 and 8)

Localities: South Australia—holotype (SAM/V2668), under rocks, upper tidal zone, Port Noarlunga, St Vincent Gulf, S. J. Edmonds, Nov., 1950.

Tasmania—2 paratypes (BM/1980.5.1.13-14), on *Sonderophycus* in 30 metres, Little Squally Cove, Deal Island, Bass Strait, S.A. Shepherd, 4.v.74.

Morphology: Strongly leaf-like and rounded oval in outline. The holotype measures 27 mm by 19.0 mm. Dorsal surface of the living worm reddish or reddish brown. Preserved specimens still retain patches of such pigment, particularly on tentacles. On the dorsal surface, there is a pair of conspicuous, non-retractile, nuchal tentacles lying 1.5 mm apart and situated at about the junction of the first and second thirds of the total length of the body. Between the tentacles lies the cerebral organ. At the base of each tentacle there is a ring of 40 or 50 tentacular eyes, and around the cerebral organ numerous cerebral eyes are scattered. The cerebral eyes show indistinctly a division into two lateral clusters, commonly found among species of the genus *Planocera* Blainville, and each cluster showing some indication of a division

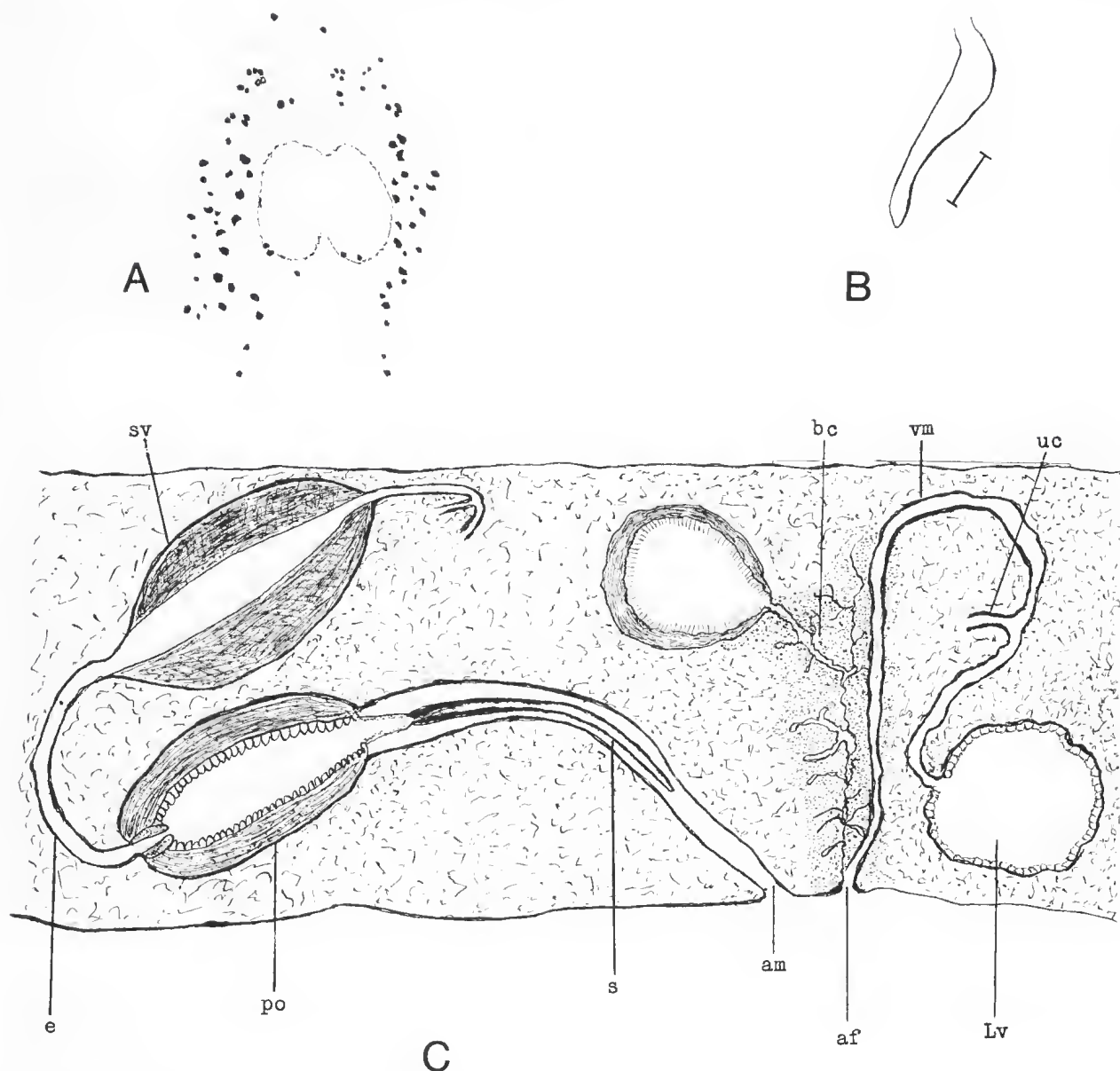


FIG 6. *Candimboides cuneiformis*. A. Arrangement of eyes; B. Penis-stylet (bar-scale=0.1 mm.) (ventral view). C. Sagittal section of copulatory complexes. *af.*, antrum femininum; *am.*, antrum masculinum; *bc.*, bursa copulatrix; *e.*, ejaculatory duct; *Lv.*, Lang's vesicle; *po.*, prostatic organ; *s.*, stylet; *sv.* seminal vesicle; *uc.*, common uterine canal; *vm.*, vagina media.

into an anterior and a posterior group in relation to the cerebral organ (Fig. 7B).

The mouth occurs in the middle region of the body, and in the largest specimen at about 5 mm behind the cerebral organ. It opens into a pharyngeal chamber, about 5 mm long, containing a well-developed pharynx possessing four pairs of deep lateral folds. The intestinal trunk is about as long as the pharyngeal chamber and has six or seven pairs of deep lateral branches and a forwardly-directed branch passing over the cerebral organ. The dendriform offshoots of the intestinal branches do not anastomose.

The male pore is situated at 3.5-4 mm posteriorly to the mouth, and the female pore 2.0-2.5 mm behind the male. The male copulatory complex lies close

behind the pharynx and is directed anteriorly from its ventral aperture. The testes are widely distributed, ventrally to the intestinal branches. The vasa deferentia arise on either side of the female copulatory complex, close to the ventral wall of the body, and take a convoluted course anteriorly to near a level with the hinder end of the pharynx, where they turn medially to open together into a seminal vesicle. The latter appears to be a structure of two compartments, one being vesicular and the other wholly muscular. The union of the vasa deferentia gives rise to a narrow ejaculatory duct which passes through the muscular compartment of the seminal vesicle to open into the vesicular compartment containing a mass of sperm. From the sperm-containing section, a narrow duct passes through the muscular section, skirting the pos-

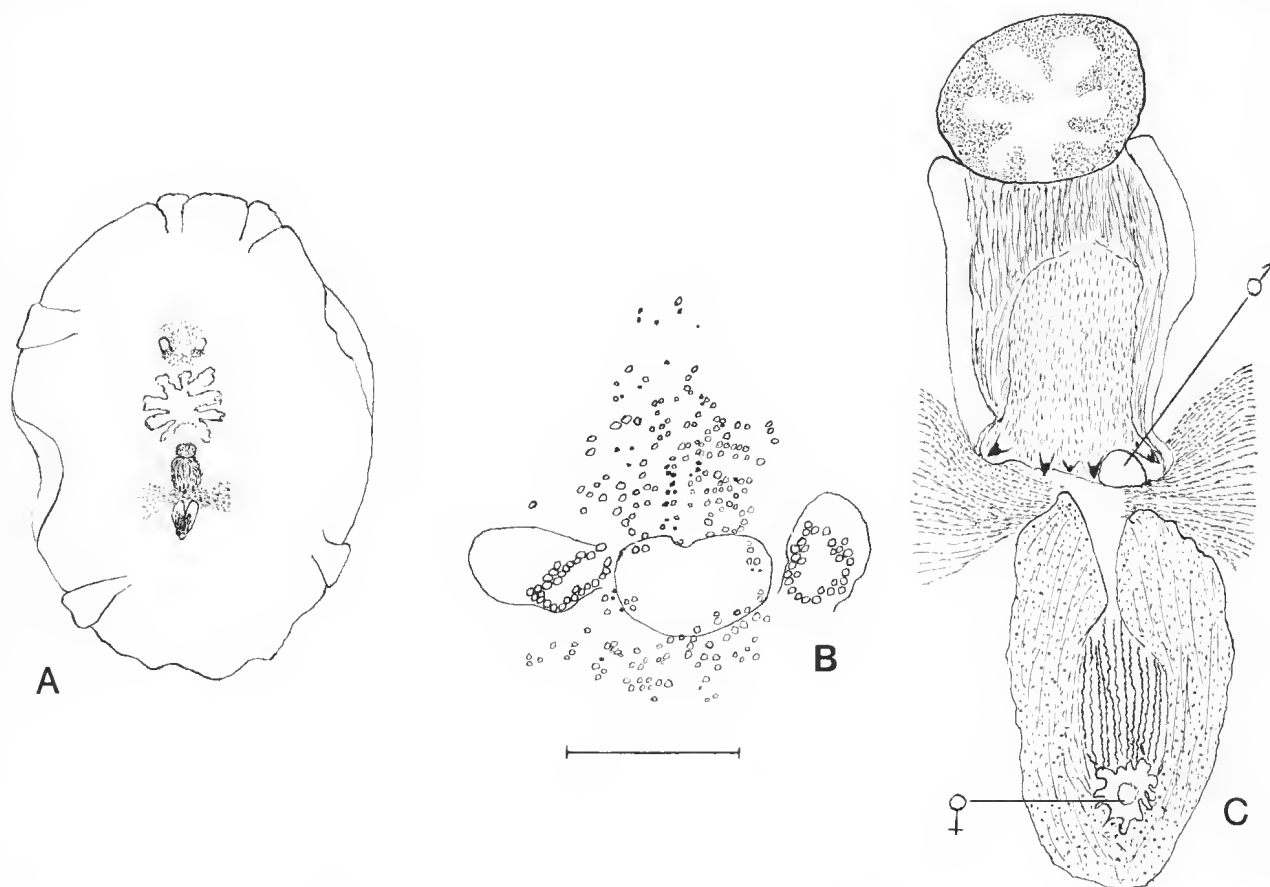


FIG 7. *Planocera edmondsi*. A. Dorsal view. B. Arrangement of eyes (bar-scale=1 mm.) C. Copulatory complexes, with their respective apertures (ventral view).

terior and ventral walls of the prostatic organ, through a pocket surrounding the proximal region of the cirrus cavity, to unite with the prostatic duct. The prostatic organ is a globular structure lying antero-dorsally to the seminal vesicle. As in other species of *Planocera*, the prostatic organ is lined with a very tall, much-folded, glandular epithelium. The prostatic duct springs from the posterior wall of the prostatic organ and soon opens into the ejaculatory duct, which enters the anterior end of the cirrus-sac or intromittent organ through a broad projection that is probably no more than a slight eversion of the inner or proximal end of the cirrus-sac, since it is covered with spines. The cirrus-sac has a narrow lumen and is lined with strong spines that gradually increase in size towards the outer or distal end. Around the opening of the cirrus-sac, as it opens into a very shallow male antrum, there are five very large spines or teeth. The cirrus-sac and the prostatic organ are invested with a thick muscular sheath, in which there is a cavity around the proximal half of the cirrus-sac and the ejaculatory duct.

The ovaries are numerous and distributed widely in the dorsal parenchyma. The female genital pore opens directly into a large bursa copulatrix provided with an exceedingly thick musculature of circular, longitudinal and radial fibres. The bursa appears to

contain three indistinct sections. The distal and proximal sections are lined with a ciliated epithelium, whereas the central section is lined with a cuticle thrown into longitudinal ridges. The bursa is directed anteriorly and leads into a wide vagina media, much of which functions as a "shell" chamber, being invested with innumerable "shell" glands. From the bursa, the vagina media makes a wide posteriorly directed curve to receive the common uterine canal. From this union, the vagina continued posteriorly as a narrow rudimentary Lang's vesicle.

Remarks: This species is named after Dr S. J. Edmonds, formerly of the University of Adelaide, and is readily differentiated from all known species of the genus *Planocera* by the unusual structure of the seminal vesicle and by the presence of five thorn-like spines embedded in the wall around the opening of the cirrus-sac.

Family GNESIOCEROTIDAE du Bois-Reymond
Marcus and Marcus, 1966, emend.

Gnesiocerinae du Bois—Reymond Marcus and Marcus, 1966

Diagnosis: Planoceroidea with elongate-oval body. Eyes in two elongate clusters alongside cerebral organ, or in paired cerebral and tentacular clusters. Pharynx

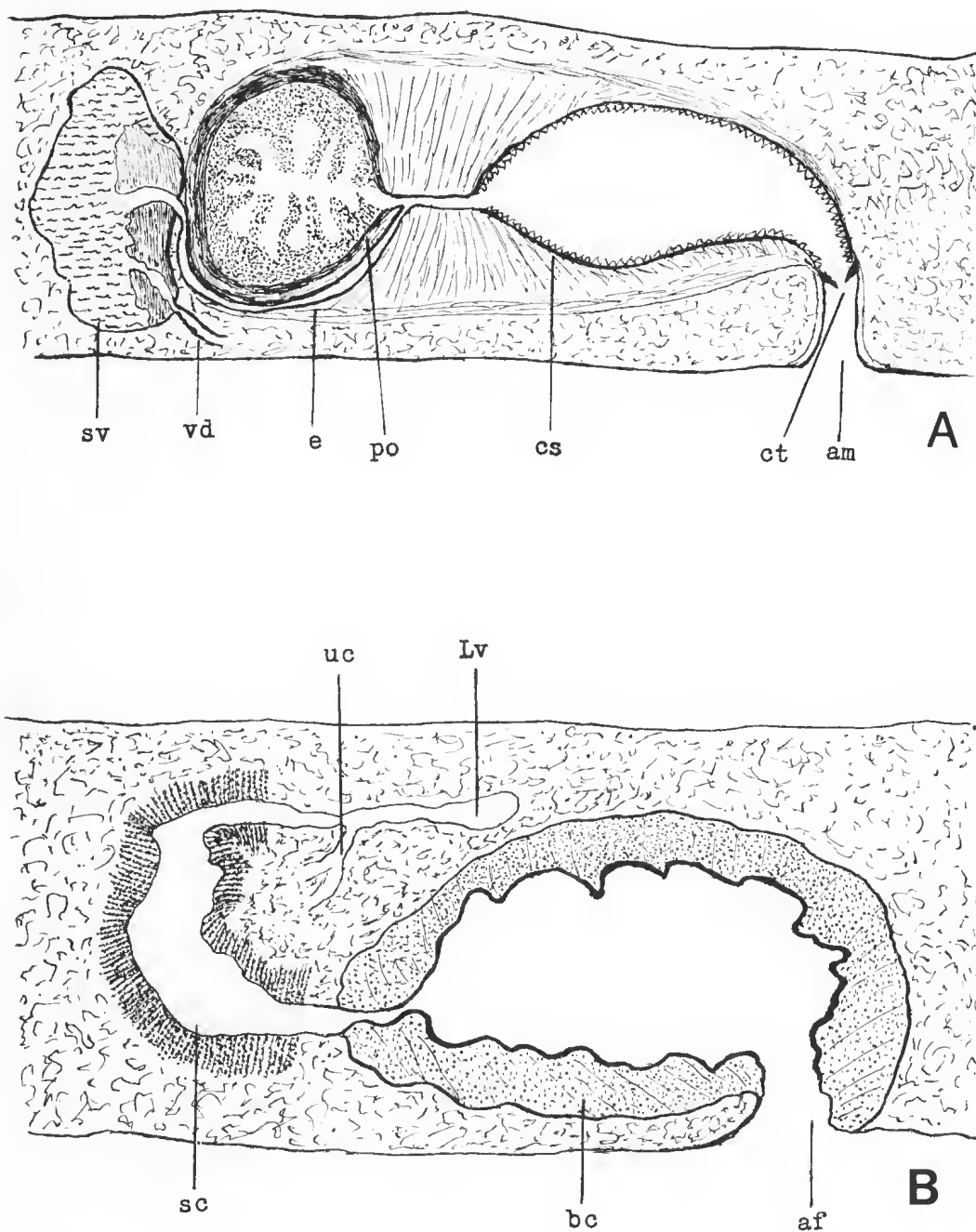


FIG. 8. *Planocera edmondsi*. A. Male copulatory complex. am., antrum masculinum; cs., cirrus-sac; ct., cirrus-teeth; e., ejaculatory duct; po., prostatic organ; sv., seminal vesicle; vd., vas deferens; B. female copulatory complex. af., antrum femininum; bc., bursa copulatrix; Lv., Lang's vesicle; sc., "shell"-chamber; uc., common uterine canal.

much folded, situated in middle region of body, or somewhat anteriorly. Genital pores separate. Vasa deferentia may form pair of accessory seminal vesicles or open into true seminal vesicle. Prostatic organ well developed, interpolated between sperm reservoir and cirrus sac. Epithelium of prostatic organ tall and thrown into folds, distal or ectal region of prostatic organ narrows to open into cirrus-sac invested with thick musculature. Cirrus-sac contains well-developed cuticularized papilla or lined with thick cuticle, often covered with stiff bristles or spines. Vagina simple, but may possess vagina bulbosa and Lang's vesicle.

Remarks: The known genera constituting this family are listed by du Bois—Reymond Marcus and Marcus (1968) under the subfamily "Gnesiocerinae". They divided the Planoceridae into two subfamilies: the Planocerinae and the Gnesiocerinae; based on the presence of an interpolated prostatic organ or of an independent or so-called "free" prostatic organ. The Gnesiocerinae is characterised by an interpolated prostatic organ, through which sperm passes during copulation, and the Planocerinae by an independent prostatic organ. The position of this organ in relation to the ejaculatory duct is of family importance among

acotylean polyclads and differentiates the family Leptoplanidae from the Callioplanidae, and the Stylochidae from the Cryptocelididae. Therefore, to be consistent in classifying acotylean polyclads, it seems necessary to raise the subfamily Gnesioceratinae (emended) to family rank.

ECHINOPLANA Haswell, 1907

Diagnosis: Gnesiocerotidae without tentacles. Eyes disposed in two elongate groups. Pharynx mainly in anterior half of body, provided with 10-15 pairs of shallow lateral folds; intestinal branches ramify and anastomose. Male and female genital pores well separated by genital sucker with corrugated surface. Seminal vesicle elongate. Prostatic organ muscular and elongate, united with cirrus-sac by convoluted ejaculatory duct enclosed in mass of muscle fibres. Cirrus-sac with thick musculature and lined with spines gradually increasing in size towards the exterior. No male antrum. Vagina narrow, directed anteriorly, invested with "shell"-glands over much of its length. Lang's vesicle rudimentary. Uterine canals confluent in median line anteriorly to pharynx.

Type-species: *E. tenerrima* Haswell, 1907.

Type-locality: Port Jackson, N.S.W., Australia.

Remarks: Although *Echinoplana* has been defined by Haswell (1907), by Bock (1913) and by Galleni (1978), for one reason or another it was necessary to redefine it. Haswell regarded *Echinoplana* as a member of the Leptoplanidae, but Bock (1913) placed it in an appendix of the Planoceridae, and it has subsequently been generally accepted as a member of the latter family. In fact, Bresslau (1928) placed it in the subfamily Planocerinae, but du Bois-Reymond Marcus and Marcus (1968) referred it to a new planocercid subfamily Gnesiocerinae (sic).

Echinoplana tenerrima Haswell, 1907

Locality: South Australia—1 specimen (SAM/V2623), Point Brown, W. Zeidler, 9.viii.74; 1 specimen (SAM/V2624), west coast of Witterbee Point, W. Zeidler, 2.iii.75; 1 specimen (SAM/V2622), under rocks, intertidal zone, Pondalowie Bay, W. Zeidler, 7.xi.76; 1 specimen (SAM/V2621), under rocks, low tide, Daly Heads, Yorke Peninsula, W. Zeidler, 9.xi.76.

Morphology: The elongate-oval body in the present material measures 12-22 mm long and 5-9 mm wide, and of a very light brown, with a dark reticulation. No nuchal tentacles. Eyes are arranged in two elongate groups, disposed laterally to the cerebral organ, each consisting of 30-50 eyes and tending to converge anteriorly. The tentacular eyes are situated in the posterior region of each group and are larger and appear nearer to the dorsal surface than the remaining

(cerebral) eyes. The cerebral organ lies between the pharynx and the anterior margin of the body, but rather nearer to the pharynx. In fact, the arrangement of the eyes in relation to the cerebral organ agrees well with that depicted by Haswell (1907) and Galleni (1978).

The pharynx is situated in the second quarter of the total length of the body from the anterior margin. It is 3-5 mm long and possesses 10-14 pairs of shallow lateral folds. The intestinal trunk is about as long as the pharynx and gives off some 14-16 pairs of lateral branches, which ramify and anastomose towards the periphery of the body. The anterior end of the intestinal trunk trifurcates, a central branch passing anteriorly over the cerebral organ and the outer branches passing forwardly round the cerebral organ.

The male and female pores are well separated and situated in the third quarter of the body. Between them lies a corrugated area, probably functioning as a genital sucker. It is covered by a tall glandular epithelium supported by a thickening of the musculature of the body wall.

The vasa deferentia appear on either side of the anterior region of the pharynx, with which they run parallel. Immediately posterior to the pharynx, they converge towards the median line to open together into the posterior end of an elongate seminal vesicle, provided with a thin muscular wall. This vesicle lies ventrally, is directed anteriorly, and terminates in a narrow ejaculatory duct. The latter leads into the anterior end of the prostatic organ through a distinct papilla projecting into the lumen of the organ. The latter is elongate and two or three times larger than the seminal vesicle, dorsally to which it lies. It is provided with a thick inner layer of circular muscle fibres and an outer layer of longitudinal fibres and is lined with a tall glandular epithelium thrown into radial folds. The prostatic organ is directed posteriorly, and its hinder end narrows to continue as a much-convoluted ejaculatory duct invested with a thick layer of muscle fibres. The ejaculatory duct opens into a long cirrus-sac having a narrow lumen and lined with cuticular spines that gradually become larger towards the exterior. The cirrus-sac is coated with a very thick wall of radial muscles, among which circular and longitudinal muscles are scattered. There is no antrum masculinum, because the cirrus-sac opens directly to the exterior. The male pore or exterior opening of the cirrus-sac is situated at 6-10 mm from the posterior end of the body.

The female genital pore lies at 2-3 mm posteriorly to the male pore and opens into a narrow vagina externa or antrum femininum, lined with a glandular epithelium similar to that of the corrugated pad. The vagina extends dorsally, but soon curves anteriorly and immediately receives efferent ducts of the invest-

ing "shell"-glands to form a narrow "shell"-chamber. From this chamber, the vagina continues anteriorly as the vagina interna, lined with a low ciliated epithelium, to near the muscular mass of the cirrus-sac, dorsally to the male opening, where it makes a short posteriorly-directed dorsal loop. Shortly before terminating, the vagina receives a short common uterine canal, thus leaving a very short prolongation, mentioned by Haswell (1907) in his generic definition, as an "unsymmetrical diverticulum", but apparently comparable with the rudimentary Lang's vesicle found in some other polyclads. This very short narrow vesicle is lined with a tall ciliated epithelium, similar to that lining the uterine canals. Immediately before and after receiving the common uterine canal, the vagina is invested with innumerable cosinophilous gland-cells opening into the vagina and producing a secretion similar to that of the "shell"-glands—this is an unusual feature among polyclads, but it is known in the planocercid genus *Disparoplana* Laidlaw. From their common entrance into the vagina, the paired uterine canals extend anteriorly alongside the pharynx and vasa deferentia to a level between the cerebral organ and the pharynx, where they are confluent in the median line. The entire vaginal system is enclosed in a dense parenchyma packed with numerous muscle fibres.

Remarks: In the main, the specimen described above agrees with the description of this species given by Haswell (1907) and exceedingly well with the worm depicted by Galleni (1978). There are, however, one or two differences, for Haswell found the epithelium of the prostatic organ to be thrown into longitudinal folds, whereas this epithelium in the present specimen appears to be thrown into radial folds, and one of his figures (2) suggests that a branch of each vas deferens extends posteriorly beyond the male copulatory complex. Moreover, Haswell speaks of an "ootype", but this appears to be that which is generally referred to by authors on polyclads as the "shell" chamber.

In two serially sectioned specimens examined by Haswell, there was evidence of hypodermic injection of spermatozoa by other individuals through the epidermis in the region of the corrugated area or genital sucker, but in the present serially sectioned specimen no such evidence has been found.

Along the Australian coasts, *Echinoplana tenerima* was known hitherto only from Port Jackson, N.S.W., where it appears to have been common more than seventy years ago. Recently, Galleni (1978) has described and figured specimens of this species from the Tuscan coast of Italy. Now that *E. tenerima* appears to be widely distributed along the coast of South Australia, it seems reasonable to assume that the occurrence of this species in the warm-temperate waters of the Mediterranean is due to its being trans-

ported in a manner similar to that mentioned above for the North American polyclad *Euplana gracilis*.

Family CESTOPLANIDAE Lang, 1884

Cestoplana meridionalis Prudhoe, 1982

(Fig. 9)

Locality: South Australia—holotype (SAM/V2613-V2620 consisting of uncut portions and serial sections) and paratype (BM/1980.5.1.7), Beachport, W. Zeidler, 9.ii.77.

Morphology: The slender holotype measures 20 mm long and 3 mm wide at the broadest region near the posterior end of the body. It has more or less parallel sides and tapers towards both extremities. The ground colour of both dorsal and ventral surfaces in the preserved condition is greyish, but there is a tendency for the body to appear brownish, due to granules of chocolate-brown pigment in the epithelium, which when sloughed off the brownish colouration is lost. There is no indication of a ventral sucker or adhesive depression in the posterior region of the body. The bilobed cerebral organ lies at 1.25 mm from the anterior end of the body. Eyes appear in the median area of the body, at a short distance posteriorly to the cerebral organ and spread fanwise over the anterior region to the submarginal zones (Fig. 9A).

The mouth is situated at about 2.6 mm from the hinder end of the body and opens into the posterior region of a short pharyngeal chamber, which contains a slightly "ruffled" pharynx about 1 mm in length. The intestinal trunk is long, reaching anteriorly from behind the pharyngeal chamber to near the cerebral organ. It possesses numerous pairs of lateral branches, which ramify towards the margins of the body, but do not anastomose.

The male genital pore is situated at about 0.65 mm posterior to the mouth and 0.4 mm anterior to the female genital pore. The testes, unlike the ovaries, do not appear to extend into the post-pharyngeal region of the body. A pair of vasa deferentia lie on either side of the pharyngeal chamber and take a convoluted course posteriorly as far as the hinder level of the female copulatory complex, where they loop inwardly to run towards one another and near the male antrum they unite to form a short ejaculatory duct. This duct extends dorsally and soon opens into a muscular, elongate-oval, seminal vesicle, which is directed anteriorly and disposed ventrally to the intestinal trunk in the region between the genital pores. The anterior end of the seminal vesicle narrows abruptly to form a short duct, which leads into the proximal region of the prostatic organ. The latter is a small somewhat pyriform structure lined with a tall glandular epithelium and invested with a thick musculature, through which pass gland-cells opening into the lumen of the prostatic organ. This organ opens directly into

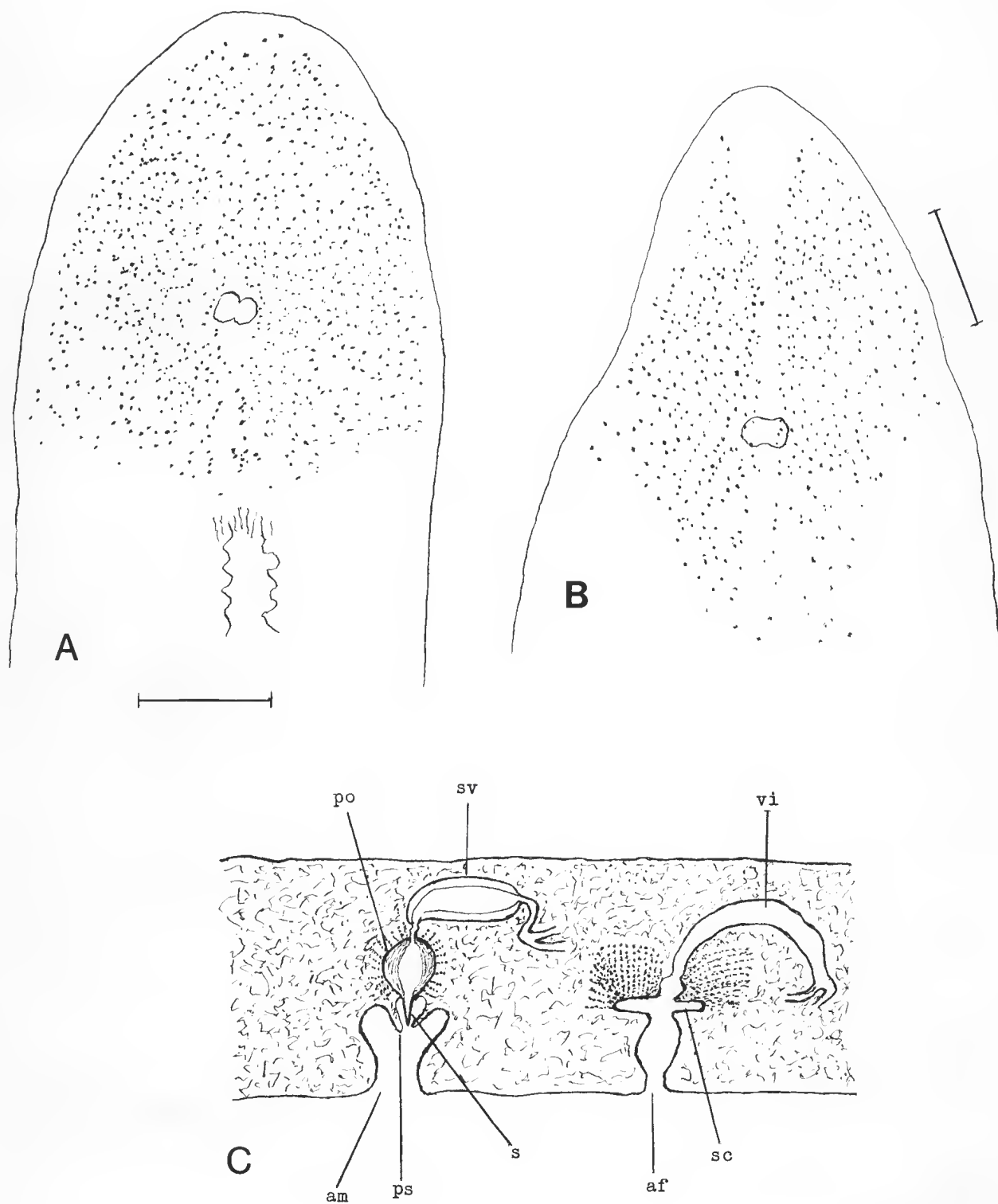


FIG. 9. *Cestoplana meridionalis*. A. Head-end of holotype (bar-scale-0.5 mm) B. Head-end of paratype (bar-scale-0.5 mm.) C. Sagittal section of copulatory complexes of holotype. af., antrum femininum; am., antrum masculinum; po., prostatic organ; ps., penis-sheath; s., stylet; sc., "shell"-chamber; sv., seminal vesicle; vi., vagina interna.

a small conical penis-papilla, tipped with a short spike of scleroid material. The armed penis-papilla is disposed vertically in a spacious penis-pocket which leads into the male antrum through a distinct penis-sheath. The male antrum is short, bulbous or somewhat pyriform.

The ovaries form a broad chain on either side of the median line and extend posteriorly from the cephalic region to near the hinder end of the body. The female genital opening is situated at about 1.5 mm from the posterior margin of the body. It opens into a narrow antrum femininum or vagina externa, which leads into a wide, dorso-ventrally compressed, "shell"-chamber. It seems that the efferent ducts of the "shell"-glands open into the chamber only through its dorsal wall and into a short portion of the distal region of the vagina interna. From the "shell"-chamber, the vagina interna, lined with a ciliated epithelium, makes a short posterior and downward curve to receive the uterine canals at its inner end. The uterine canals extend anteriorly from their union with the vagina, but are not yet fully developed.

The paratype specimen is also slender, but a little larger than the holotype, measuring 22 mm long and 3.5 mm wide. Its coloration is also chocolate-brown dorsally. The distribution of its eyes (Fig. 9B) is different from that in the holotype, inasmuch as there is a narrow median space, widening anteriorly, and devoid of eyes, a feature often seen in specimens of other species of *Cestoplana*. This apparent difference in the two present specimens probably arose because of a contraction of the cephalic region of the holotype at fixation. Although neither set of gonads has reached maturity, the male and female copulatory complexes are almost fully developed and are more or less comparable with those in the holotype.

Remarks: The diagnostic features of *Cestoplana meridionalis* are the chocolate-brown colouration of the body, the lack of a ventral adhesive pad posteriorly, the union of the vasa deferentia to form a common duct entering the seminal vesicle and the armed penis-papilla. The combination of these features enables this species to be readily differentiated from hitherto described species of *Cestoplana*.

Haswell (1907) erected the species *Cestoplana australis* for an immature polyclad found between the tide-marks at Woollahra Point, Port Jackson, N.S.W. Apparently it possesses a light ground colour, becoming reddish orange posteriorly. In addition, close to each lateral border there is a band of "vivid vermilion" and a median band of similar colour along the length of the body. Haswell recognized the very close resemblance of this species with the European *Cestoplana rubrocincta* (Grube, 1840,) and Kato (1944) has considered the two forms to be synonymous.

Family PSEUDOCEROTIDAE Lang, 1884 emend. Poche, 1926

Pseudoceros reticulatus Yeri and Kaburaki, 1918

Localities: South Australia—1 specimen (BM/1980.7.14), under stones, 5 m deep, Tipara Reef, 14 km west from Port Hughes, S.A. Shepherd; 1 specimen (AM/W17748), 5 m deep, Penneshaw, Kangaroo Island, N. Coleman, 12.iii.78.

Tasmania—several specimens (BM/1980.5.1.2-4 and AM/W17751), on reef, 5 m deep, Georges Bay, St Helens, N. Coleman, 6.10.77.

Morphology: The specimen from Tipara Reef is somewhat discoid in outline, measuring about 25 mm both long and wide, whereas the specimen from Kangaroo Island is oval in outline and measures 45 mm long and 25 mm wide. The several specimens from Tasmania are mainly a little smaller and distorted, but after some manipulation they were found to be oval in outline, measuring 18 mm-30 mm long and 10 mm-15 mm wide. The body is rather delicate, and the dorsal surface of the Tasmanian specimens is dark grey, has thick reticulation of grey or reddish brown, with much lighter interstices; ventrally the body is lighter than the dorsal surface, with no reticulation. In these specimens, the dorsal surface also shows many dark grey pigment spots of varying size, as well as numerous small dark spots, due to underlying ovaries. In fact, these specimens agree exceptionally well with the coloured figure of this species given by Yeri and Kaburaki (1918). In one or two specimens, there are indications of a whitish margin to the body, frequently interrupted by dull grey patches. A dark median band exists over the main-gut and is dappled with whitish patches. In a kodachrome taken by Neville Coleman, the living animal from Tasmania is translucent, brownish, with a diffusion of white over most of the dorsal surface of the body, interspersed with white spots. The white patches in the median band and the interruptions to the whitish marginal band observed in the preserved material are quite apparent in the living worm.

The specimens from South Australia are somewhat lighter in colour. They possess the dark median band, similarly dappled, and their marginal zones show a reticulation of grey, but the areas between the median band and the marginal zones are of a light yellowish brown. The dorsal surface is likewise spotted with dark grey pigment, but ventrally the spots are absent. The dark dots seen in the Tasmanian specimens are less apparent here, for the yolk material in the ovaries is much lighter in colour. In a kodachrome, also taken by N. Coleman, the living animal from Kangaroo Island appears translucent, brownish, with a greyish reticulation covering the dorsal surface.

A pair of tentacles appear as mere folds of the

anterior margin of the body and are tipped with white. Each tentacle contains numerous eyes beneath the dorsal and ventral surfaces, the number of which increases, with the size of the body. The cerebral eyes lie dorsally to the cerebral organ, and in the larger specimens they form a compact rounded group, whereas in the smaller specimens they appear to be arranged more or less in two semicircles disposed one behind the other.

The histological condition of the available material is not good, nevertheless the subepithelial musculature of the Tasmania material appears to consist of five layers of fibres, both dorsally and ventrally. There is an outer and an inner layer of longitudinal muscles and between them are two layers of muscles forming a criss-cross pattern enclosing a central layer of circular muscles.

The copulatory complexes are very similar in both sets of specimens and agree well with those described by Yeri and Kaburaki (1918). There is, however, one feature of disagreement, for in the original specimens the male copulatory complex lies closely posterior to the pharynx, whereas in the specimens of both the present sets the complex is situated ventrally to the hinder region of the pharynx, a feature possibly due to contraction at fixation.

Remarks: *Pseudoceros reticulatus* appears to be common in the warm-temperate waters of the east coast of Japan (Kato, 1944) and has been recorded from the coast of Vietnam (Dawydoff, 1952). Its occurrence in southern Australian waters indicates that this species is either widely distributed in the Indo-West Pacific region, or that it has been artificially transported by some means or other from the northern area of this region to southern Australia.

Pseudoceros lividus sp. nov.

Locality: South Australia—holotype (AM/W17750), on sponge, 5 m deep, Kingscote, Kangaroo Island, N. Coleman, 13.iii.78.

Morphology: The holotype has been preserved in formalin and is much contracted. It is oval in outline and is 5 mm long and 3 mm wide. It does not appear to be sexually mature. In a kodachrome taken by N. Coleman, the living worm is bluish, dorsally and ventrally, with a white margin. Because of the heavy pigmentation, it has not been possible to make out the arrangement of the eyes, even when an attempt was made to clear the worm in methyl salicylate. A small ventral sucker is centrally situated in the median line.

Remarks: Over 100 species of *Pseudoceros* have been described, mainly from the Indo-Pacific region. Hyman (1954) pointed out that the differentiation of species in this genus has been based almost solely on

the pattern of coloration, although very little is known of variation in this feature. Nevertheless, two or three species have been described as showing much variety in colour, but there are one or two instances of where the pattern of coloration is remarkably constant.

Only two of the known species of *Pseudoceros* have a bluish ground colour and these are *P. concinnus* Stummer-Traunfels, 1933, *nec* (Collingwood, 1876) Kaburaki, 1923, and *P. tristriatus* Hyman, 1959. In both of these species, the dorsal surface is bluish with a median and two submarginal bands of yellow, and the present form being without any bands of coloration is regarded as a new species.

Thysanozoon skottsbergi Bock, 1923

Locality: South Australia—1 specimen (SAM/V2666), Beachport, W. Zeidler, 9.ii.77; 1 specimen (BM/1980.5.1.19), only "South Australia" known, S. A. Shepherd.

Remarks: Both specimens are mature and closely resemble those recorded by the present writer (1977) from Gun Island and Fremantle, Western Australia. *Thysanozoon skottsbergi* was originally recorded from Masatierra Island, one of the Juan Fernandez group, off the coast of Chile.

Family EURYLEPTIDAE Stimpson, 1857

Cycloporus australis Prudhoe, 1982

(Fig. 10)

Locality: South Australia—holotype (AM/W177499) and paratype (BM 1980.5.1.22), American River, Kangaroo Island, N. Coleman, 8.iii.78.

Morphology: The two specimens, preserved in formalin, are broadly oval in outline and measure 9–10 mm long and 6.5–7 mm wide. Dorsally, they are smooth and brownish, with widely-scattered dark spots, due to underlying ovaries, and a lighter coloured marginal band. In a kodachrome taken by N. Coleman of the two specimens when alive, both appear translucent and tinged with brown, with whitish spots scattered over the dorsal surface and yellowish patches distributed intermittently along the margins of the body. Again, we have an instance of where in the living animal the ovarian follicles are seen through the dorsal epidermis of the body as whitish dots, but when preserved in formalin the yolk-material in each follicle becomes darkened and the ovaries appear as dark spots. The ventral surface of the body is of a uniform lighter colour, except where the uterine canals filled with eggs appear as whitish lines on either side of the median line. A muscular ventral sucker lies in the middle region of the body.

The marginal tentacles, even when alive, according to the kodachrome, are inclined to be indefinite, and in the preserved condition they appear as slight folds

of the anterior margin of the body. Numerous eyes occur in the tentacles, more especially ventrally, while the numerous cerebral eyes lie over the cerebral organ in two distinct rectangular clusters, about twice as long as wide.

The dorsal epithelium of the body is taller than the ventral epithelium and tightly packed with rhabdite cells, each of which contains several rhabdites. The basement membrane is relatively thick, whereas the subepithelial musculature appears to be rather insignificant.

The mouth lies at about 1 mm from the anterior margin of the body, close behind the cerebral organ, and opens into a short pharyngeal chamber enclosing a campanulate pharynx. From the pharyngeal chamber, the median intestinal trunk extends to the posterior region of the body, giving off 8 or 9 pairs of lateral branches as it proceeds posteriorly. Anteriorly, the intestinal trunk trifurcates, a central branch passing directly over the cerebral organ and a pair of branches passing alongside the organ. The lateral intestinal branches ramify and anastomose rather loosely and terminate in numerous elongate vesicles in the marginal regions of the body. The vesicles open to the exterior through minute pores in the peripheral epithelium. It seems likely that the yellowish patches seen on the margins of the living animal are due to undigested material lying in the terminal vesicles of the digestive system.

The male genital pore is situated at 0.3 mm posterior to the mouth and the female pore 1.3 mm posterior to the male pore. The testes are widely distributed ventrally to the intestinal branches and reach to near the margins of the body. The vasa deferentia arise on either side of the median line at about midway between the female genital pore and the ventral sucker. Proximally, they are narrow thin-walled canals, but distally they are wide and lined with a well-developed glandular epithelium, an unusual feature in polyclads. On reaching anteriorly as far as the hinder margin of the pharyngeal chamber, they turn medially, narrow and, without uniting, open separately into a seminal vesicle. This vesicle is bulbous, with a thick muscular wall, and lies ventral to the hinder region of the pharyngeal chamber. From

the seminal vesicle, a short ejaculatory duct extends anteriorly to open into a penis-papilla. The prostatic organ is an elongate oval structure lying between the pharyngeal chamber and the ejaculatory duct. It is considerably larger than the seminal vesicle, and is lined with a relatively tall glandular epithelium, invested with a well-developed musculature. From its anterior end, a short prostatic duct leads into the ejaculatory duct as it opens into the penis-papilla. This papilla is very small, but armed with a strong stylet lying in a muscular penis-pocket, which opens into a spacious antrum masculinum through a thick conical penis-sheath.

The widely scattered ovaries lie dorsal to the intestinal branches and extend to near the margins of the body. They are larger than the testes. The female copulatory complex presents the typical cotylean structure which seldom undergoes modification. The female genital pore opens into a widened antrum feminum or vagina externa, lined with a densely ciliated epithelium. The female antrum leads through a narrow aperture in its dorsal wall into a swollen dorsoventrally flattened "shell"-chamber, into which open the efferent ducts of innumerable investing "shell"-glands. From the "shell"-chamber, a muscular vagina interna extends dorsally to receive the common thin-walled uterine passage. A pair of symmetrically disposed uterine canals extends anteriorly as far as the male complex and then turns to run posteriorly to a short distance beyond the vaginal complex. The short uterine canals each bears 3 lateral uterine vesicles, suggesting that when the canals are fully developed and more elongate they may have about 9 pairs of vesicles.

Remarks: According to a differential key to the species of the genus *Cycloporus* Lang given by du Bois-Reymond Marcus and Marcus (1968), the present form bears a very strong resemblance to *C. gabriellae* Marcus, 1950, from Brazil and the Caribbean. Apart from a difference in coloration, the greater number of eyes enables *C. australis* to be readily differentiated from other species of the genus so far described. In their key, Marcus and Marcus did not include *C. maculatus* Hallez, 1893, which is distinguished by the cerebral and tentacular eyes merging to form an elongate cluster.

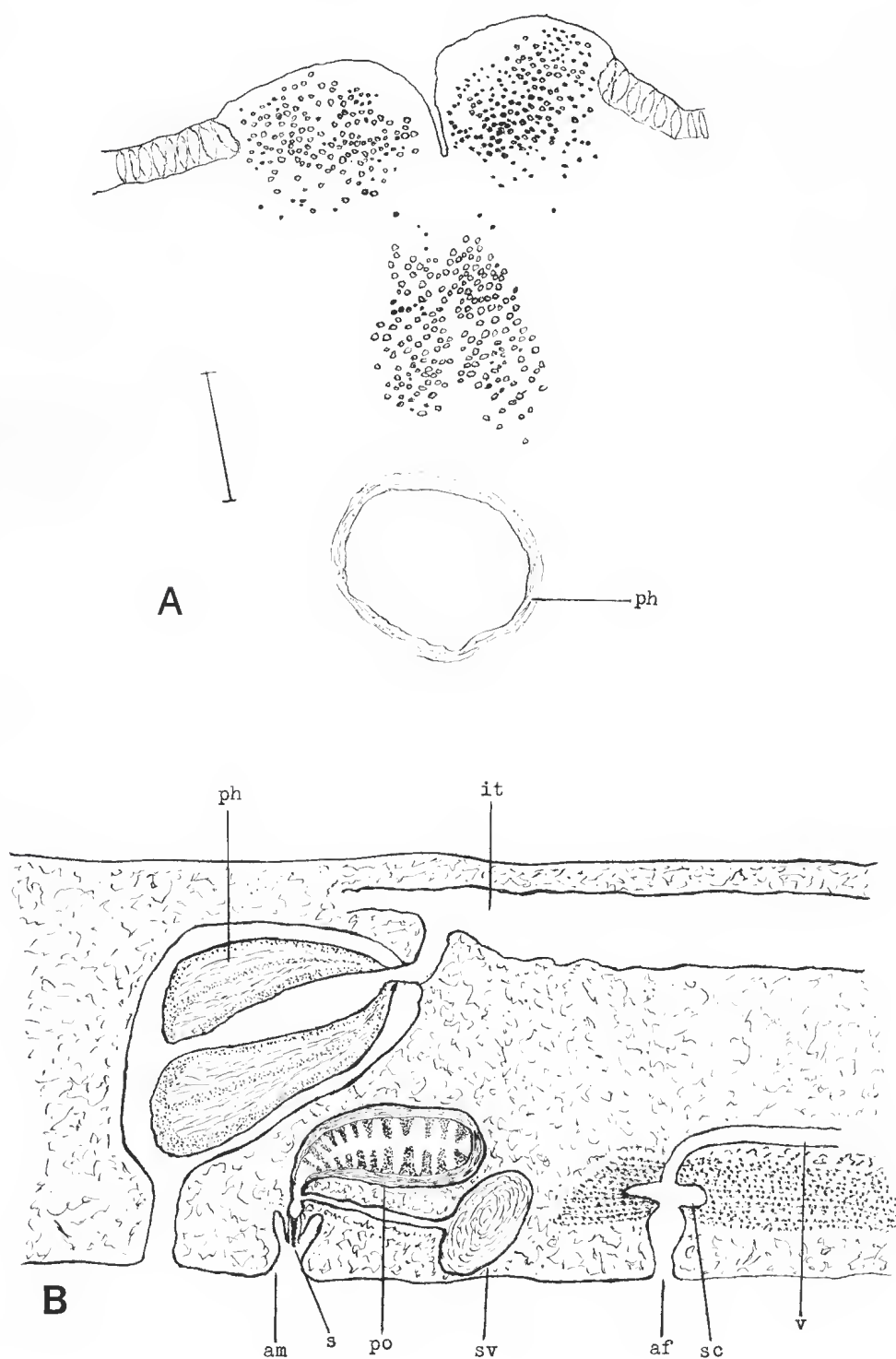


FIG. 10. *Cycloporus australis*. A. Arrangement of eyes. *ph.*, pharynx (bar-scale-0.5 mm) B. Sagittal section of copulatory complexes. *af.*, antrum femininum; *am.*, antrum masculinum; *it.*, intestinal trunk; *ph.*, pharynx; *po.*, prostatic organ; *s.*, stylet; *sc.*, "shell"-chamber; *sv.*, seminal vesicle; *v.*, vagina.

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